

BRAKES

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BASE BRAKE SYSTEM

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DESCRIPTION AND OPERATION

BASE BRAKE SYSTEM

DESCRIPTION

The base brake system consists of the following components:

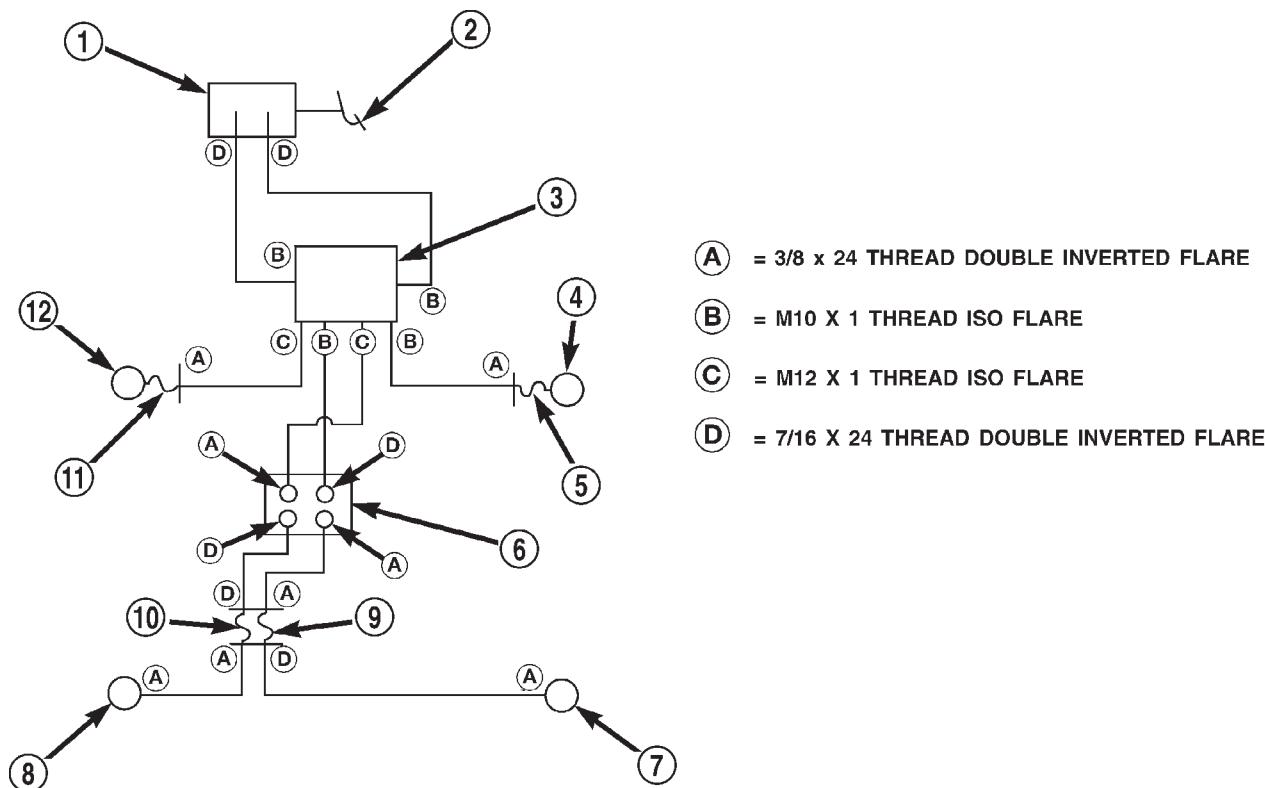
- Brake pedal
- Power brake booster
- Master cylinder
- Brake tubes and hoses
- Proportioning valve
- Disc brakes

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- Drum brakes
- Brake lamp switch
- Brake fluid level switch
- Parking brakes

Front disc brakes control the braking of the front wheels; rear braking is controlled by rear drum brakes or rear disc brakes depending on options.

The hydraulic brake system is diagonally split on both the non-antilock braking systems (Fig. 1) and antilock braking systems (Fig. 2). This means the left front and right rear brakes are on one hydraulic circuit and the right front and left rear are on the other.

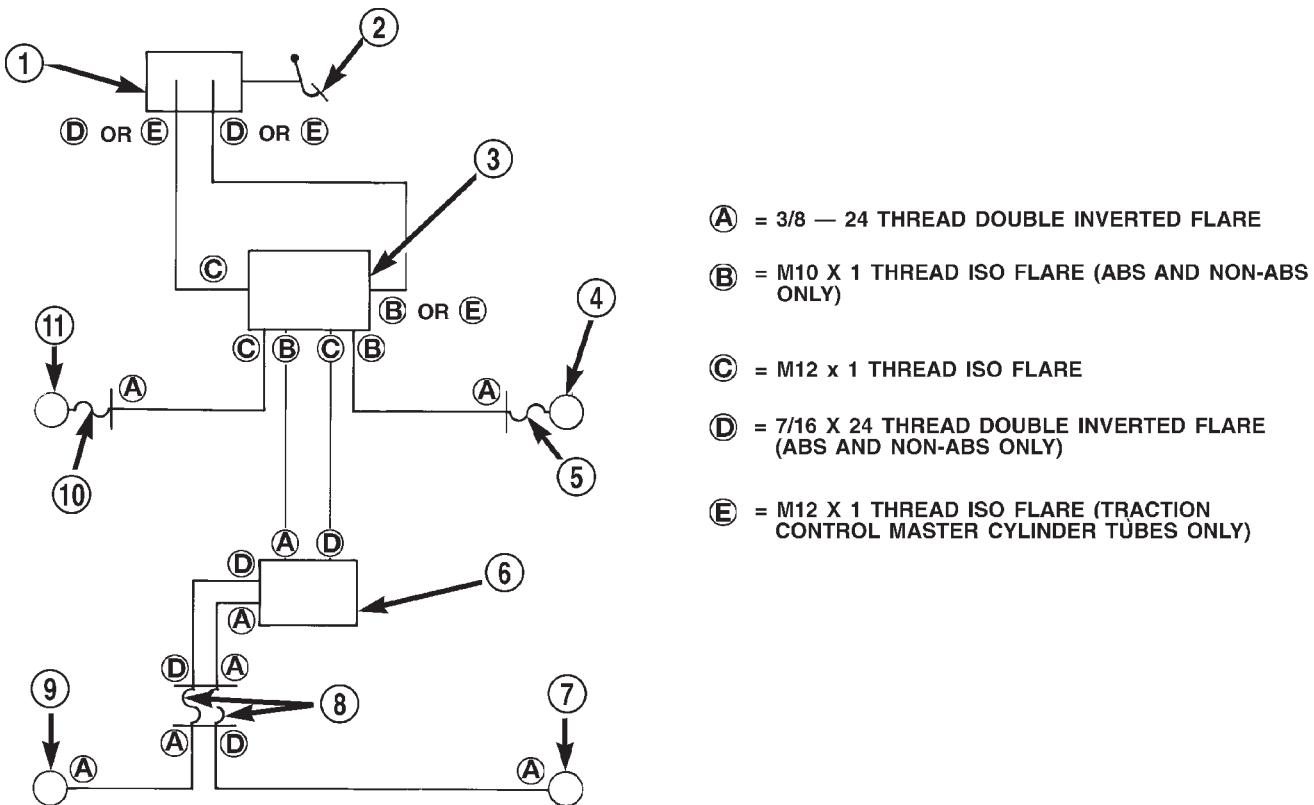


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Fig. 1 Non-Antilock Brake Hydraulic Brake Tube Routing And Fitting Locations

- | | |
|---------------------------------------|-----------------------|
| 1 – MASTER CYLINDER | 7 – RIGHT REAR BRAKE |
| 2 – BRAKE PEDAL | 8 – LEFT REAR BRAKE |
| 3 – JUNCTION BLOCK | 9 – HOSE |
| 4 – RIGHT FRONT BRAKE | 10 – HOSE |
| 5 – HOSE | 11 – HOSE |
| 6 – HEIGHT-SENSING PROPORTIONAL VALVE | 12 – LEFT FRONT BRAKE |

DESCRIPTION AND OPERATION (Continued)



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Fig. 2 Antilock Brake Hydraulic Brake Tube Routing And Fitting Locations

- 1 – MASTER CYLINDER
 2 – BRAKE PEDAL
 3 – ABS MODULATOR ASSEMBLY
 4 – RIGHT FRONT BRAKE
 5 – HOSE
 6 – FIXED PROPORTIONING VALVE

- 7 – RIGHT REAR BRAKE
 8 – HOSE
 9 – LEFT REAR BRAKE
 10 – HOSE
 11 – LEFT FRONT BRAKE

Vehicles equipped with the optional antilock brake system (ABS) use a system designated Mark 20i. It is available with or without traction control. This system shares most base brake hardware used on vehicles without ABS. A vehicle equipped with ABS, however, uses an integrated control unit (ICU), four wheel speed sensors, and an electronic controller referred to as the controller antilock brake (CAB). These components are described in detail in the ANTILOCK BRAKE SYSTEM section in this group of the service manual.

OPERATION

When a vehicle needs to be stopped, the driver applies the brake pedal. The brake pedal pushes the input rod of the power brake booster into the booster. The booster uses vacuum to ease pedal effort as force is transferred through the booster to the master cylinder. The booster's output rod pushes in the master cylinder's primary and secondary pistons applying

hydraulic pressure through the chassis brake tubes to the brakes at each tire and wheel assembly.

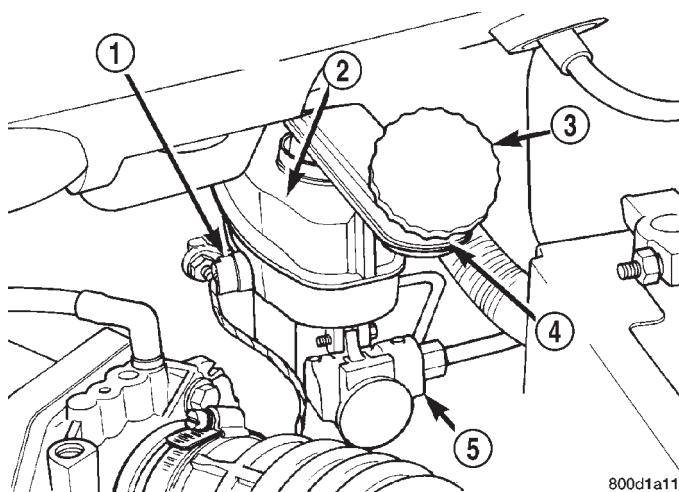
The parking brakes are foot-operated. When applied, the parking brake lever pulls on cables that actuate brake shoes at each rear wheel. The parking brake mechanism has an automatic adjusting feature that takes up any excessive slack in the parking brake system.

MASTER CYLINDER**DESCRIPTION**

The master cylinder is located on the power brake booster in the engine compartment on the driver's side (Fig. 3). This vehicle uses 3 different master cylinders. Master cylinder usage depends on what type of brake system the vehicle is equipped with.

If a vehicle is not equipped with antilock brakes, or is equipped with antilock brakes without traction control, a conventional compensating port master cyl-

DESCRIPTION AND OPERATION (Continued)



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Fig. 3 Master Cylinder

- 1 – BRAKE FLUID LOW LEVEL SWITCH
- 2 – BRAKE FLUID RESERVOIR
- 3 – CAP
- 4 – FILLER NECK
- 5 – MASTER CYLINDER ASSEMBLY

inder is used. If a vehicle is equipped with antilock brakes with traction control, a dual center port master cylinder is used. The third master cylinder used on this vehicle is unique to vehicles equipped with four wheel disc brakes (All-Wheel-Drive models). The master cylinder used for this brake application has a different bore diameter and stroke than the master cylinder used for the other available brake applications.

The master cylinders used on front wheel drive applications (non-four wheel disc brake vehicles) have a master cylinder piston bore diameter of 23.8 mm. The master cylinder used on the All-Wheel-Drive applications (four wheel disc brake vehicles) have a master cylinder piston bore diameter of 25.4 mm. **When replacing a master cylinder, be sure to use the correct master cylinder for the type of brake system the vehicle is equipped with.**

The body of the master cylinder is an anodized aluminum casting. It has a machined bore to accept the master cylinder pistons and threaded ports with seats for the hydraulic brake line connections.

The brake fluid reservoir is mounted on the top of the master cylinder. It is made of a see-through polypropylene type plastic. A brake fluid level switch is attached to the brake fluid reservoir.

The master cylinder is not a repairable component and must be replaced if diagnosed to be functioning improperly. The brake fluid reservoir and brake fluid level switch can be replaced separately.

CAUTION: Do not hone the bore of the cylinder as this will remove the anodized surface from the bore.

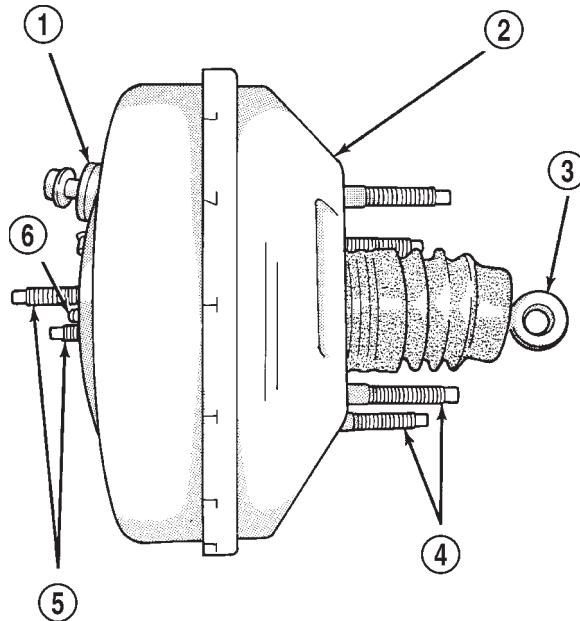
OPERATION

When the brake pedal is depressed, the master cylinder primary and secondary pistons apply brake pressure through the chassis tubes to the brakes at each tire and wheel assembly.

The master cylinder primary outlet port supplies hydraulic pressure to the right front and left rear brakes. The secondary outlet port supplies hydraulic pressure to the left front and right rear brakes.

POWER BRAKE BOOSTER**DESCRIPTION**

The power brake booster mounts on the engine compartment side of the dash panel. It is connected to the brake pedal by the input (push) rod (Fig. 4). The master cylinder is bolted to the front of the power brake vacuum booster assembly. A vacuum line connects the power brake booster to the intake manifold.



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Fig. 4 Power Brake Booster

- 1 – VACUUM CHECK VALVE
- 2 – POWER BRAKE BOOSTER ASSEMBLY
- 3 – INPUT ROD
- 4 – POWER BOOSTER ASSEMBLY TO DASH PANEL MOUNTING STUDS (4)
- 5 – MASTER CYLINDER MOUNTING STUDS (2)
- 6 – OUTPUT ROD

All vehicles use a 270 mm single diaphragm vacuum power brake booster.

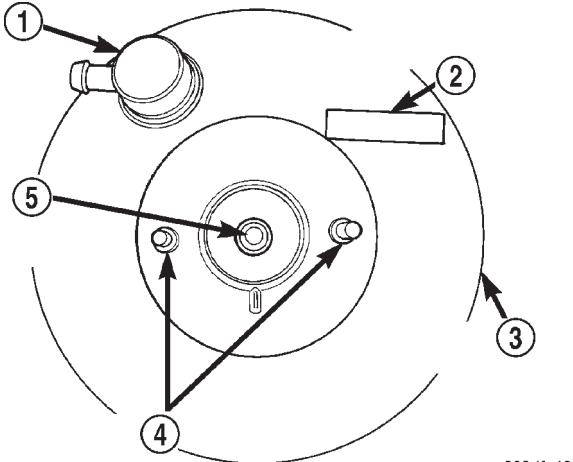
All vehicles use a common power brake booster, except models equipped with All-Wheel-Drive (AWD). Differences between the two are internal. Service is the same on all boosters.

The power brake booster can be identified by the tag attached to the body of the booster (Fig. 5). This

DESCRIPTION AND OPERATION (Continued)

tag contains the production part number, the date it was built, and who the manufacturer of the power brake booster is.

NOTE: The power brake booster assembly is not a repairable component and must be replaced as a complete assembly if it is found to be faulty in any way. The check valve located on the power brake booster (Fig. 5) is not repairable, but it can be replaced separately from the power brake booster.



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Fig. 5 Power Brake Booster Identification

- 1 - VACUUM CHECK VALVE
- 2 - PART IDENTIFICATION TAG
- 3 - POWER BRAKE BOOSTER ASSEMBLY
- 4 - MASTER CYLINDER MOUNTING STUDS
- 5 - MASTER CYLINDER PUSH ROD

The different engine combinations used in this vehicle require different vacuum hose routings to the power brake booster. All vacuum hoses must be routed from the engine to the power brake booster without kinks or excessively tight bends.

OPERATION

The power brake booster reduces the amount of force required by the driver to obtain the necessary hydraulic pressure to stop a vehicle.

The power brake booster is vacuum operated. The vacuum is supplied from the intake manifold on the engine through a vacuum hose and the power brake booster check valve (Fig. 5) (Fig. 4).

As the brake pedal is depressed, the power brake booster's input rod moves forward (Fig. 4). This opens and closes valves in the power booster allowing atmospheric pressure to enter on one side of a diaphragm. Engine vacuum is always present on the other side. This difference in pressure forces the output rod of the power brake booster out against the primary piston of the master cylinder. As the pistons in the master cylinder move forward this creates the hydraulic pressure in the brake system.

BRAKE TUBES AND HOSES

DESCRIPTION

The chassis brake tubes are steel with a corrosion resistant coating applied to the external surfaces. The flex hoses are made of reinforced rubber.

OPERATION

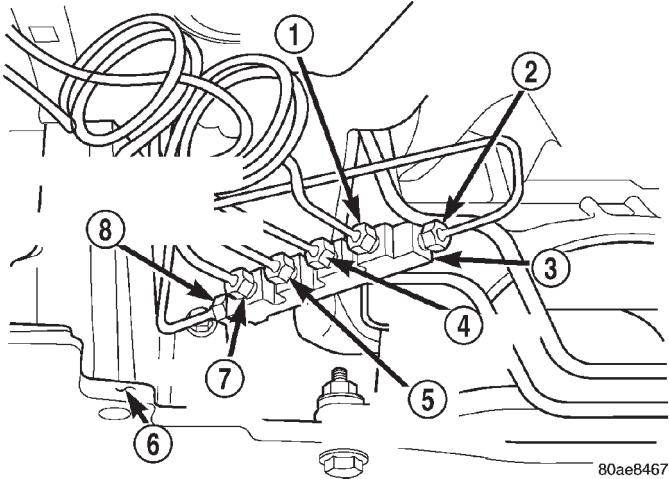
The purpose of the chassis brake tubes and flex hoses is to transfer the pressurized brake fluid developed by the master cylinder to the wheel brakes of the vehicle. The flex hoses are made of rubber to allow for the movement of the vehicle's suspension.

JUNCTION BLOCK

DESCRIPTION

A junction block is used on vehicles that are not equipped with antilock brakes (ABS). The junction block is located on the driver's side of the front suspension cradle/crossmember (Fig. 6). The junction block mounts in the same location as the ABS integrated control unit (ICU) does on vehicles equipped with ABS.

It has six threaded ports to which the brake tubes connect. Two are for the brake tubes coming from the master cylinder. The remaining four are for the brake tubes going to each brake assembly.



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Fig. 6 Junction Block

- 1 - RIGHT FRONT WHEEL
- 2 - CHASSIS BRAKE TUBE FROM MASTER CYLINDER
- 3 - JUNCTION BLOCK
- 4 - LEFT REAR WHEEL
- 5 - RIGHT REAR WHEEL
- 6 - FRONT SUSPENSION CRADLE
- 7 - LEFT FRONT WHEEL
- 8 - CHASSIS BRAKE TUBE FROM MASTER CYLINDER

OPERATION

The junction block distributes the brake fluid coming from the master cylinder primary and secondary

DESCRIPTION AND OPERATION (Continued)

ports to the four brake tubes leading to the brakes. Since the junction block mounts in the same location as the ABS integrated control unit (ICU), it allows for the common use of brake tubes going to the brakes at each tire and wheel assembly on the vehicle whether it is equipped with or without ABS.

NOTE: Although the brake tubes coming from the master cylinder to the junction block or ABS ICU may appear to be the same, they are not. They are unique to each brake system application.

PROPORTIONING VALVE

There are two different type proportioning valves used on this vehicle depending brake system application. Vehicles equipped with Antilock Brakes (ABS) use a fixed proportioning valve. Vehicles not equipped with ABS use a height sensing proportioning valve.

Information on the height sensing proportioning valve is covered in this section. Information on the fixed proportioning valve is covered in the Antilock Brake System section.

CAUTION: The use of after-market load leveling or load capacity increasing devices on this vehicle are prohibited. Using air shock absorbers or helper springs on this vehicle will cause the height sensing proportioning valve to inappropriately reduce the hydraulic pressure to the rear brakes. This inappropriate reduction in hydraulic pressure potentially could result in increased stopping distance of the vehicle.

HEIGHT SENSING PROPORTIONING VALVE

DESCRIPTION

Vehicles not equipped with ABS brakes use a height sensing proportioning valve. The height sensing proportioning valve is mounted on the left frame rail in front of the rear axle (Fig. 7). The height sensing proportioning valve uses an actuator to attach the proportioning valve to the left rear spring for sensing changes in vehicle height.

OPERATION

The height sensing proportioning valve operates similarly to a standard proportioning valve in the following way. As hydraulic pressure is applied to the valve, full input hydraulic pressure is supplied to the rear brakes up to a certain pressure point, called the split point. Beyond the split point, the proportioning valve reduces the amount of hydraulic pressure to the rear brakes according to a given ratio. Thus, on light brake applications, approximately equal hydraulic pressure will be transmitted to both the front and rear brakes. Upon heavier brake applications, the hydraulic pressure transmitted to the rear brakes will be

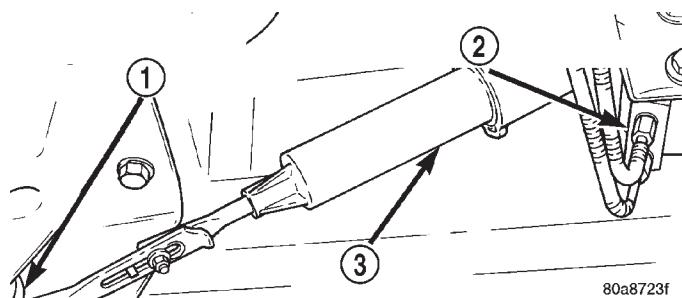


Fig. 7 Height Sensing Proportioning Valve

- 1 – LEFT REAR LEAF SPRING ACTUATOR BRACKET
2 – HEIGHT SENSING PROPORTIONING VALVE
3 – ACTUATOR ASSEMBLY

lower than the front brakes. This will prevent premature rear wheel lock-up and skid.

Here is how the height sensing proportioning valve differs from a standard proportioning valve. As the height of the rear suspension changes, the height sensing portion of the proportioning valve changes the split point of the proportioning valve. When the height of the rear suspension is low, the proportioning valve interprets this as extra load and the split point of the proportioning valve is raised to a higher pressure to allow for more rear braking. When the height of the rear suspension is high, the proportioning valve interprets this as a light load and the split point of the proportioning valve is lowered to a lower pressure and rear braking is reduced.

The height sensing proportioning valve regulates the pressure by sensing the load condition of the vehicle through the movement of the proportioning valve actuator (Fig. 7). The actuator is mounted between the height sensing proportioning valve and the actuator bracket on the left rear leaf spring. As the position of the left rear leaf spring changes, depending on the load the vehicle is carrying, the movement is transferred through the actuator bracket and actuator, to the proportioning valve. The proportioning valve adjusts the hydraulic pressure accordingly.

The height sensing proportioning valve allows the brake system to maintain the optimal front to rear brake balance regardless of the vehicle load condition. Under a light load condition, hydraulic pressure to the rear brakes is minimized. As the rear load condition increases, so does the hydraulic pressure to the rear brakes.

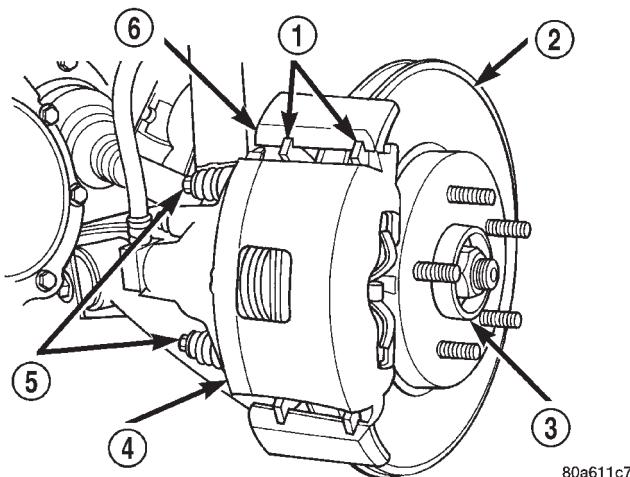
DISC BRAKES (FRONT)

DESCRIPTION

The front disc brakes (Fig. 8) consists of the following components:

- Braking disc (rotor).
- Caliper assembly.
- Shoes and linings.

DESCRIPTION AND OPERATION (Continued)

**Fig. 8 Front Disc Brake Components**

- 1 - BRAKE PADS AND LININGS
- 2 - BRAKE ROTOR
- 3 - DRIVING HUB
- 4 - CALIPER ASSEMBLY
- 5 - GUIDE PIN BOLTS
- 6 - STEERING KNUCKLE

The double pin brake caliper is mounted directly to the steering knuckle using bushings, sleeves, and 2 caliper guide pin bolts (Fig. 9). The guide pin bolts thread directly into the steering knuckle (Fig. 10).

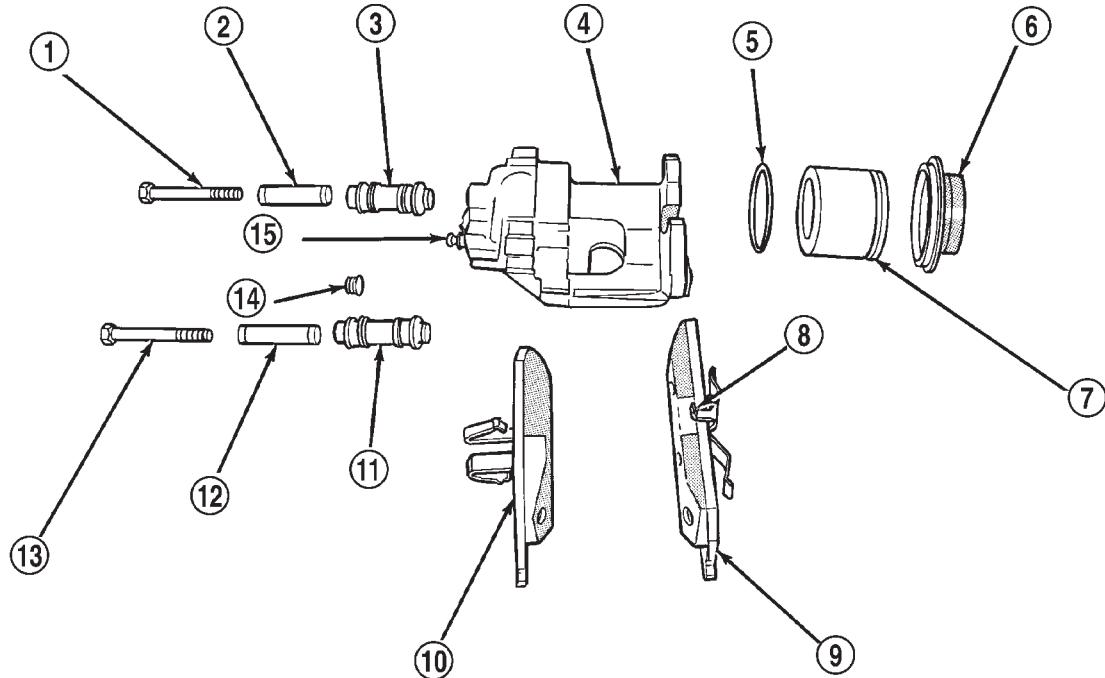
The brake caliper is a one piece casting with the inboard side containing a single piston cylinder bore (Fig. 9). The phenolic piston is 60 mm (2.36 inch) in diameter.

OPERATION

The two machined abutments on the steering knuckle position and align the caliper fore and aft. The guide pin bolts, sleeves, and bushings control the side-to-side movement of the caliper. The piston seal is designed to assist in maintaining the proper brake shoe-to-rotor clearance.

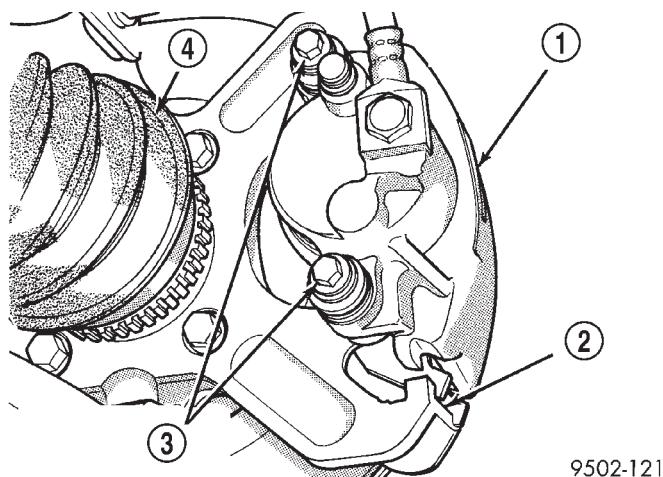
All the front brake forces generated during braking of the vehicle are taken up directly by the steering knuckles of the vehicle.

A square cut rubber piston seal is located in a machined groove in the cylinder bore. It provides a hydraulic seal between the piston and the cylinder wall (Fig. 11).

**Fig. 9 Front Disc Brake Caliper (Exploded View)**

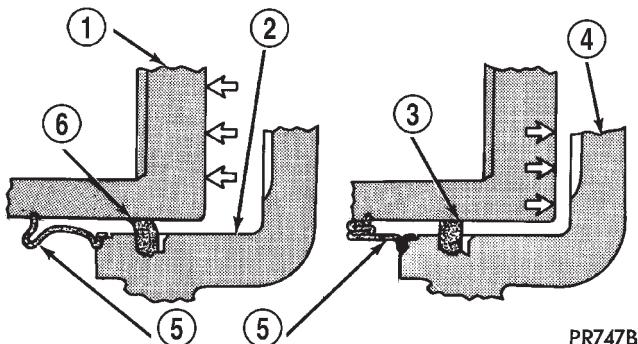
- 1 - CALIPER GUIDE PIN BOLT
- 2 - SLEEVE
- 3 - BUSHING
- 4 - CALIPER
- 5 - PISTON SEAL
- 6 - DUST SEAL
- 7 - PISTON
- 8 - WEAR INDICATOR
- 9 - BRAKE SHOE
- 10 - BRAKE SHOE
- 11 - BUSHING
- 12 - SLEEVE
- 13 - CALIPER GUIDE PIN BOLT
- 14 - CAP
- 15 - BLEEDER SCREW

DESCRIPTION AND OPERATION (Continued)

**Fig. 10 Disc Brake Caliper Mounting**

- 1 - DISC BRAKE CALIPER ASSEMBLY
 2 - STEERING KNUCKLE
 3 - DISC BRAKE CALIPER MOUNTING BOLTS
 4 - DRIVESHAFT

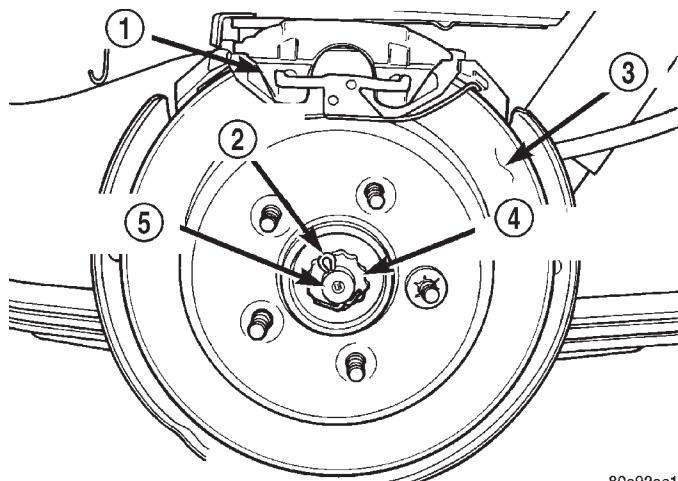
The molded rubber dust boot mounts in a counter bore of the cylinder bore opening and in a groove which is machined in the outer surface of the piston (Fig. 11). This prevents contamination of the piston and the bore area.

**Fig. 11 Caliper Piston Seal Function For Automatic Adjustment**

- 1 - PISTON
 2 - CYLINDER BORE
 3 - PISTON SEAL BRAKE PRESSURE OFF
 4 - CALIPER HOUSING
 5 - DUST BOOT
 6 - PISTON SEAL BRAKE PRESSURE ON

DISC BRAKES (REAR)**DESCRIPTION**

There are several distinctive features to the rear disc brakes on this vehicle (Fig. 12). The single piston, floating caliper rear disc brake system includes a hub and bearing assembly, adapter, rotor, caliper, and brake shoes.

**Fig. 12 Rear Disc Brakes**

- 1 - CALIPER
 2 - COTTER PIN
 3 - ROTOR
 4 - NUT RETAINER
 5 - OUTER C/V JOINT

This vehicle is equipped with a caliper having a 42 mm (1.65 in.) piston and uses a 15 inch solid non-vented brake rotor. The brake rotor is described as a drum-in-hat style because of its dual role as a braking disc and parking brake drum.

The parking brake system on vehicles equipped with rear disc brakes consists of a small duo-servo drum brake mounted to the caliper adapter and uses the interior of the rear disc brake rotor as a drum (hat section of drum-in-hat style brake rotor).

OPERATION

The rear disc brakes operate similarly to front disc brakes, however, there are some features that require different service procedures.

The disc brake caliper is mounted at the 12 O'clock position. It floats on rubber bushings using threaded guide pin bolts which are attached to the back side of the adapter.

DESCRIPTION AND OPERATION (Continued)

The adapter and rotor shield are mounted to the rear axle (Fig. 13). The adapter is used to mount the parking brake shoes and actuating cables for the parking brake system. The adapter is also used to mount the rear caliper and brake shoes. The adapter has two machined abutments which are used to position and align the caliper and brake shoes for movement inboard and outboard.

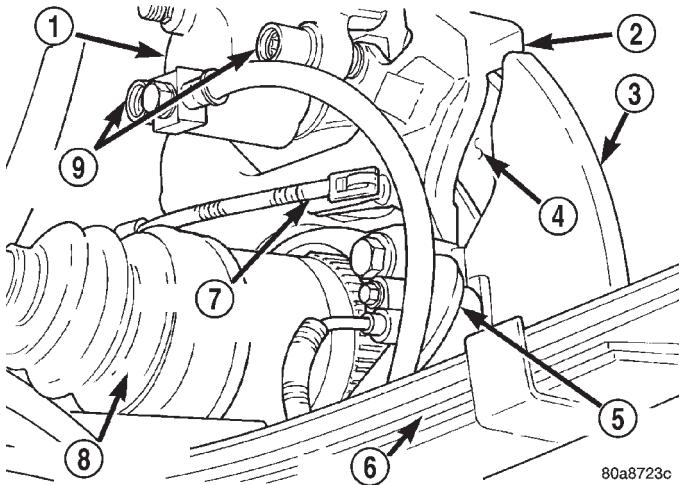


Fig. 13 Rear Disc Brake Mounting

- 1 - CALIPER
- 2 - ADAPTOR
- 3 - ROTOR SHIELD
- 4 - ROTOR
- 5 - REAR AXLE
- 6 - LEAF SPRING
- 7 - PARK BRAKE CABLE
- 8 - DRIVESHAFT
- 9 - GUIDE PIN BOLTS

The inside of each rear brake rotor is used as the drum for the parking brake system for vehicles equipped with rear disc brakes. When the parking brake is applied, the parking brake shoes expand out against a braking surface (hat section) on the inside of the brake rotor.

DRUM BRAKES (REAR)

DESCRIPTION

This vehicle's rear wheel drum brakes are a two-shoe, internal-expanding type with an automatic adjuster screw. The automatic adjuster screw is located directly below the wheel cylinder that is mounted near the top of the brake assembly (Fig. 14). These and two brake shoes (and attaching parts) are mounted to a support plate at each rear wheel. A brake drum covers each brake assembly.

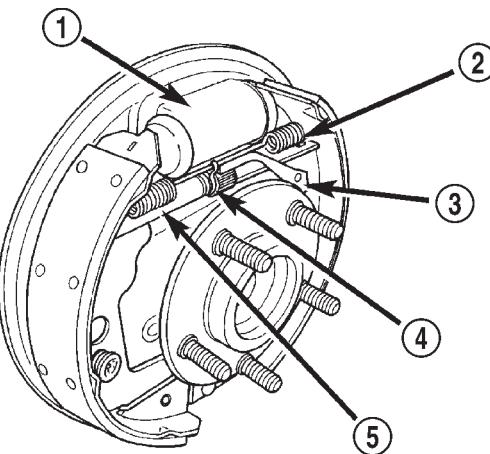


Fig. 14 Drum Brake Assembly (Right Side Shown)

- 1 - WHEEL CYLINDER
- 2 - BRAKE SHOE UPPER RETURN SPRING
- 3 - AUTOMATIC ADJUSTER LEVER
- 4 - TENSION CLIP
- 5 - AUTOMATIC ADJUSTER ASSEMBLY

OPERATION

When the brakes are applied, the wheel cylinder's pistons move outward causing the brake shoes to expand outward against the brake drum. When the brakes are released, the wheel cylinder's pistons move inward and the shoes return to their normally released position with aid from brake shoe return springs.

The automatic adjuster screw is actuated each time the brakes are applied, keeping the brakes in adjustment.

PARKING BRAKES

DESCRIPTION

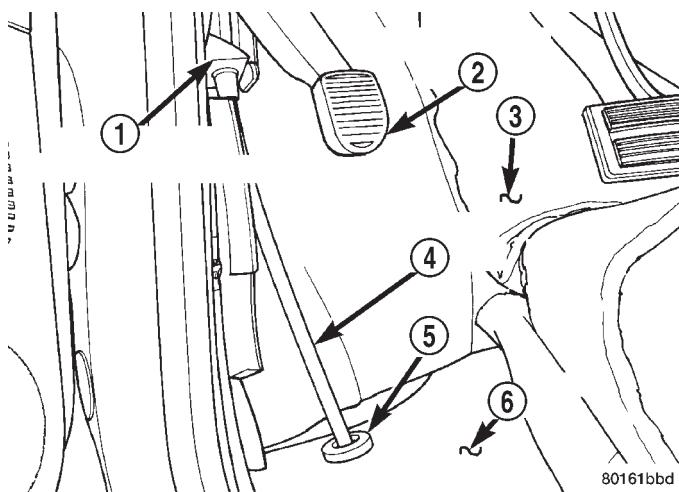
The parking brake system is operated by a foot operated parking brake lever. The parking brake lever is mounted on the body of the vehicle to the left of the brake pedal (Fig. 15). It is a automatic-adjusting type lever.

The vehicle has four flexible steel parking brake cables. They are:

- Front
- Intermediate
- Left rear
- Right rear

The front parking brake cable extends from the parking brake lever. A steel equalizer bracket connects the front parking brake cable to the left rear and intermediate cable. The intermediate cable is connected to the right rear cable using a parking brake cable connector.

DESCRIPTION AND OPERATION (Continued)

**Fig. 15 Parking Brake Lever (Pedal)**

- 1 – PARK BRAKE PEDAL ASSEMBLY
 2 – PARK BRAKE PEDAL
 3 – CARPET
 4 – FRONT PARK BRAKE CABLE
 5 – SEAL
 6 – FLOOR PAN

On vehicles equipped with rear drum brakes, the rear service brakes also act as the vehicle's parking brakes.

Vehicles equipped with rear disc brakes use a small duo-servo brake assembly mounted to the each rear disc brake caliper adapter as the parking brake. The inside of the brake rotor (hat section of drum-in-hat style brake rotor) is used as the parking brake drum.

OPERATION

The automatic-adjusting feature in the foot operated parking brake lever continuously applies minimal tension to the parking brake cables when the parking brake lever is in the released position to keep them in adjustment at all times. Due to this feature, the parking brake cables require no periodic adjustment.

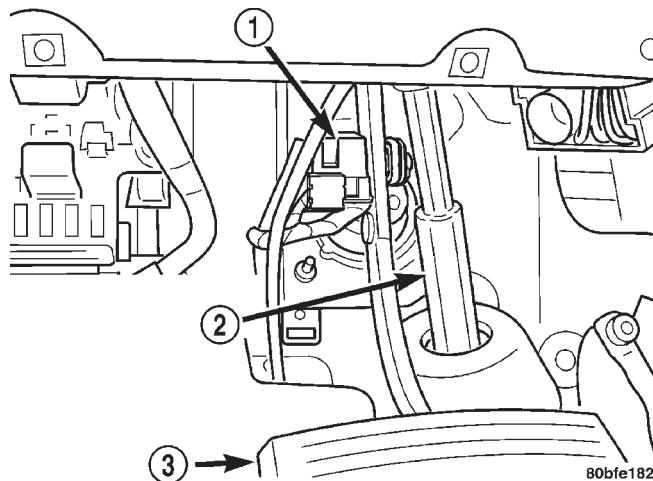
When the parking brake lever is applied, the cables are pulled, thus applying the brake shoes (rear drum brakes) or parking brake shoes (rear disc brakes) at each rear wheel.

The brake shoes are mechanically operated by an internal lever and strut connected to the rear parking brake cables.

An equalizer bracket is used at the rear end of the front parking brake cable to distribute tension equally to each parking brake cable.

BRAKE LAMP SWITCH**DESCRIPTION**

The brake lamp switch is located under the instrument panel at the brake pedal arm (Fig. 16). The brake lamp switch has three internal switches.

**Fig. 16 Brake Lamp Switch**

- 1 – SWITCH
 2 – STEERING COLUMN INTERMEDIATE SHAFT
 3 – BRAKE PEDAL

OPERATION

The three internal switches within the brake lamp switch are used for various systems. Among them are:

- Brake lamps
- Antilock brakes
- Speed control

When the brake pedal is in the released position, the plunger on the outside of the switch is pushed inward. In this position, the electrical contacts for one internal switch are open while the electrical contacts for the other two internal switches are closed.

When the brake pedal is depressed, the plunger on the outside of the switch extends outward. This action closes the electrical contacts of one, and opens the electrical contacts of the remaining two internal switches within the brake lamp switch.

Applying the brake pedal completes the circuit to the brake lamps at the rear of the vehicle, thus illuminating the brake lamps and the center-high-mounted stop lamp (CHMSL). If the vehicle is equipped with speed control and it is in use, the brake lamp switch will deactivate speed control when the brake pedal is depressed.

DESCRIPTION AND OPERATION (Continued)

BRAKE FLUID LEVEL SWITCH

DESCRIPTION

The brake fluid level switch is located in the brake fluid reservoir of the master cylinder (Fig. 17).

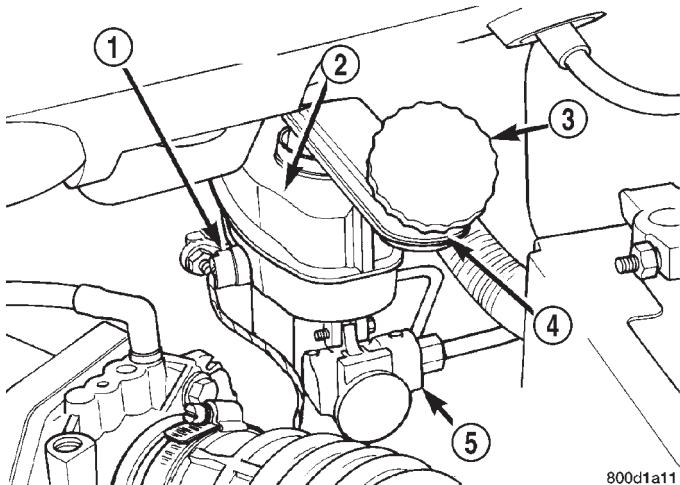


Fig. 17 Brake Fluid Level Switch

- 1 – BRAKE FLUID LOW LEVEL SWITCH
- 2 – BRAKE FLUID RESERVOIR
- 3 – CAP
- 4 – FILLER NECK
- 5 – MASTER CYLINDER ASSEMBLY

OPERATION

The purpose of the brake fluid level switch is to provide the driver with an early warning that the brake fluid level in the master cylinder fluid reservoir has dropped below a normal level. This may indicate:

- Abnormal loss of brake fluid in the master cylinder fluid reservoir resulting from a leak in the hydraulic system.

- Brake shoe linings which have worn to a point requiring replacement.

As the brake fluid drops below the minimum level, the brake fluid level switch closes to complete the red BRAKE warning lamp circuit. This will turn on the red BRAKE warning lamp. The master cylinder fluid reservoir should be checked and refilled to the full mark with DOT 3 brake fluid. **If the brake fluid level has dropped below the add line in the master cylinder fluid reservoir, the entire brake hydraulic system should be checked for evidence of a leak.**

RED BRAKE WARNING LAMP

DESCRIPTION

The red BRAKE warning lamp is located in the instrument panel cluster and is used to indicate a low brake fluid condition or that the parking brake is applied. In addition, the brake warning lamp is turned on as a bulb check by the ignition switch every time the ignition switch is placed in the crank position.

OPERATION

The red BRAKE warning lamp is supplied a 12-volt ignition feed anytime the ignition switch is on. The bulb is then illuminated by completing the ground circuit either through the switch on the parking brake lever, the brake fluid level switch in the master cylinder reservoir, or the ignition switch when it is placed in the crank position.

DIAGNOSIS AND TESTING

BASE BRAKE SYSTEM DIAGNOSIS CHARTS

NOTE: There are three diagnosis charts following that cover the RED BRAKE WARNING LAMP, BRAKE NOISE and OTHER BRAKE CONDITIONS.

RED BRAKE WARNING LAMP

CONDITION	POSSIBLE CAUSES	CORRECTION
RED BRAKE WARNING LAMP ON	1. Parking brake lever not fully released. 2. Parking brake warning lamp switch on parking brake lever. 3. Brake fluid level low in reservoir. 4. Brake fluid level switch. 5. Mechanical instrument cluster (MIC) problem.	1. Release parking brake lever. 2. Inspect and replace switch as necessary. 3. Fill reservoir. Check entire system for leaks. Repair or replace as required. 4. Disconnect switch wiring connector. If lamp goes out, replace switch. 5. Refer to Chassis Diagnostic Procedures manual.

DIAGNOSIS AND TESTING (Continued)

BRAKE NOISE

CONDITION	POSSIBLE CAUSES	CORRECTION
DISC BRAKE CHIRP	1. Excessive brake rotor runout. 2. Lack of lubricant on brake caliper slides.	1. Follow brake rotor diagnosis and testing. Correct as necessary. 2. Lubricate brake caliper slides.
DISC BRAKE RATTLE OR CLUNK	1. Broken or missing anti-rattle spring clips on shoes. 2. Caliper guide pins loose.	1. Replace brake shoes. 2. Tighten guide pins.
DISC BRAKE SQUEAK AT LOW SPEED (WHILE APPLYING LIGHT BRAKE PEDAL EFFORT)	1. Brake shoe linings.	1. Replace brake shoes.
DRUM BRAKE CHIRP	1. Lack of lubricant on brake shoe support plate where shoes ride.	1. Lubricate shoe contact areas on brake shoe support plates.
DRUM BRAKE CLUNK	1. Drum(s) have threaded machined braking surface.	1. Reface or replace drake drums as necessary.
DRUM BRAKE HOWL OR MOAN	1. Lack of lubricant on brake shoe support plate where shoes ride and at the anchor. 2. Rear brake shoes.	1. Lubricate shoe contact areas on brake shoe support plates and at the anchor. 2. Replace rear brake shoes.
DRUM BRAKE SCRAPING OR WHIRRING	1. ABS wheel speed sensor or tone wheel.	1. Inspect, correct or replace faulty component(s).
SCRAPING (METAL-TO-METAL).	1. Foreign object interference with brakes. 2. Brake shoes worn out.	1. Inspect brakes and remove foreign object. 2. Replace brake shoes. Inspect rotors and drums. Reface or replace as necessary.

OTHER BRAKE CONDITIONS

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKES CHATTER	1. Rear brake drum out of round or disc brake rotor has excessive thickness variation.	1. Isolate condition as rear or front. Reface or replace brake drums or rotors as necessary.
BRAKES DRAG (FRONT OR ALL)	1. Contaminated brake fluid. 2. Binding caliper pins or bushings. 3. Binding master cylinder. 4. Binding brake pedal. 5. Brake lamp switch not adjusted properly and mounting bracket is bent.	1. Check for swollen seals. Replace all system components containing rubber. 2. Replace pins and bushings 3. Replace master cylinder. 4. Replace brake pedal. 5. Straighten mounting bracket and adjust brake lamp switch.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
BRAKES DRAG (REAR ONLY)	<ol style="list-style-type: none"> 1. Parking brake cables binding or froze up. 2. Parking brake cable return spring not returning shoes. 3. Service brakes not adjusted properly (rear drum brakes only). 	<ol style="list-style-type: none"> 1. Check cable routing. Replace cables as necessary. 2. Replace cables as necessary. 3. Follow the procedure listed in the adjustment section.
BRAKES GRAB	<ol style="list-style-type: none"> 1. Contaminated brake shoe linings. 2. Improper power brake booster assist. 	<ol style="list-style-type: none"> 1. Inspect and clean, or replace shoes. Repair source of contamination. 2. Refer to power brake booster in the diagnosis and testing section.
EXCESSIVE PEDAL EFFORT	<ol style="list-style-type: none"> 1. Obstruction of brake pedal. 2. Low power brake booster assist. 3. Glazed brake linings. 4. Brake shoe lining transfer to brake rotor. 	<ol style="list-style-type: none"> 1. Inspect, remove or move obstruction. 2. Refer to power brake booster in the diagnosis and testing section. 3. Reface or replace brake rotors as necessary. Replace brake shoes. 4. Reface or replace brake rotors as necessary. Replace brake shoes.
EXCESSIVE PEDAL TRAVEL (VEHICLE STOPS OK)	<ol style="list-style-type: none"> 1. Air in brake lines. 2. Rear drum brake auto-adjuster malfunctioning. 	<ol style="list-style-type: none"> 1. Bleed brakes. 2. Inspect and replace drum brake components as necessary. Adjust rear brakes.
EXCESSIVE PEDAL TRAVEL (ONE FRONT WHEEL LOCKS UP DURING HARD BRAKING)	<ol style="list-style-type: none"> 1. One of the two hydraulic circuits to the front brakes is malfunctioning. 	<ol style="list-style-type: none"> 1. Inspect system for leaks. Check master cylinder for internal malfunction.
PEDAL PULSATES/ SURGES DURING BRAKING	<ol style="list-style-type: none"> 1. Rear brake drum out of round or disc brake rotor has excessive thickness variation. 	<ol style="list-style-type: none"> 1. Isolate condition as rear or front. Reface or replace brake drums or rotors as necessary.
PEDAL IS SPONGY	<ol style="list-style-type: none"> 1. Air in brake lines. 2. Power brake booster runout (vacuum assist). 	<ol style="list-style-type: none"> 1. Bleed brakes. 2. Check booster vacuum hose and engine tune for adequate vacuum supply. Refer to power brake booster in the diagnosis and testing section.
PREMATURE REAR WHEEL LOCKUP	<ol style="list-style-type: none"> 1. Contaminated brake shoe linings. 2. Inoperative proportioning valve. 3. Improper power brake booster assist. 	<ol style="list-style-type: none"> 1. Inspect and clean, or replace shoes. Repair source of contamination. 2. Test proportioning valves following procedure listed in diagnosis and testing section. Replace valves as necessary. 3. Refer to power brake booster in the diagnosis and testing section.

DIAGNOSIS AND TESTING (Continued)

CONDITION	POSSIBLE CAUSES	CORRECTION
STOP LAMPS STAY ON	1. Brake lamp switch out of adjustment. 2. Brake pedal binding. 3. Obstruction in pedal linkage. 4. Power Brake Booster not allowing pedal to return completely.	1. Adjust brake lamp switch. 2. Inspect and replace as necessary. 3. Remove obstruction. 4. Replace power brake booster.
VEHICLE PULLS TO RIGHT OR LEFT ON BRAKING	1. Frozen brake caliper piston. 2. Contaminated brake shoe lining. 3. Pinched brake lines. 4. Leaking piston seal. 5. Suspension problem.	1. Replace frozen piston or caliper. Bleed brakes. 2. Inspect and clean, or replace shoes. Repair source of contamination. 3. Replace pinched line. 4. Replace piston seal or brake caliper. 5. Refer to the Suspension group.
PARKING BRAKE - EXCESSIVE HANDLE TRAVEL	1. Rear drum brakes or parking brake shoes out of adjustment.	1. Adjust rear drum brake shoes, or rear parking brake shoes on vehicles with rear disc brakes.

POWER BRAKE BOOSTER

BASIC TEST

(1) With engine off, depress and release the brake pedal several times to purge all vacuum from the power brake booster.

(2) Depress and hold the pedal with light effort (15 to 25 lbs. pressure), then start the engine.

The pedal should fall slightly, then hold. Less effort should be needed to apply the pedal at this time. If the pedal fell as indicated, perform the VACUUM LEAK TEST listed after the BASIC TEST. If the pedal did not fall, continue on with this BASIC TEST.

(3) Disconnect the vacuum hose on the vacuum check valve, then place a vacuum gauge in line between the vacuum hose and the valve.

(4) Start the engine.

(5) When the engine is at warm operating temperature, allow it to idle and check the vacuum at the gauge.

If the vacuum supply is 12 inches Hg (40.5 kPa) or more, the power brake booster is defective and must be replaced. If the vacuum supply is below 12 inches, continue on with this BASIC TEST.

(6) Shut off the engine.

(7) Connect the vacuum gauge to the vacuum reference port on the engine intake manifold.

(8) Start the engine and observe the vacuum gauge.

If the vacuum is still low, check the engine tune and repair as necessary. If the vacuum is above 12

inches, the hose or check valve to the booster has a restriction or leak.

Once an adequate vacuum supply is obtained, repeat the BASIC TEST.

VACUUM LEAK TEST

(1) Disconnect the vacuum hose on the vacuum check valve, then place a vacuum gauge in line between the vacuum hose and the valve.

(2) Start the engine.

(3) Allow the engine to warm up to normal operating temperature and engine idle.

(4) Using vacuum line pliers, close off the vacuum supply hose near the booster, but before the vacuum gauge, then observe the vacuum gauge.

If the vacuum drop exceeds 1.0 inch Hg (3.3 kPa) in one minute, repeat the above steps to confirm the reading. The vacuum loss should be less than 1.0 inch Hg in one minute time span. If the loss is more than 1.0 inch Hg, replace the power brake booster. If it is not, continue on with this test.

(5) Remove the pliers from the hose temporarily.

(6) Apply light effort (approximately 15 lbs. of force) to the brake pedal and hold the pedal steady. Do not move the pedal once the pressure is applied or the test results may vary.

(7) Have an assistant reattach the vacuum line pliers to the vacuum supply hose.

(8) Allow 5 seconds for stabilization, then observe the vacuum gauge.

If the vacuum drop exceeds 3.0 inches Hg (10 kPa) in 15 seconds, repeat the above steps to confirm the

DIAGNOSIS AND TESTING (Continued)

reading. The vacuum loss should be less than 3.0 inches Hg in 15 seconds time span. If the loss is more than 3.0 inches Hg, replace the power brake booster. If it is not, the booster is not defective.

(9) Remove the pliers and vacuum gauge.

PROPORTIONING VALVE (HEIGHT SENSING)

CAUTION: The use of aftermarket load leveling or load capacity increasing devices on this vehicle are prohibited. Using air shock absorbers or helper springs on this vehicle will cause the height sensing proportioning valve to inappropriately reduce the hydraulic pressure to the rear brakes. This inappropriate reduction in hydraulic pressure potentially could result in increased stopping distance of the vehicle.

When a premature rear wheel skid is obtained on a brake application, it may be an indication that the hydraulic pressure to the rear brakes is above the specified output from the proportioning valve. This condition indicates a possible malfunction of the height sensing proportioning valve, which will require testing to verify that it is properly controlling the hydraulic pressure allowed to the rear brakes. Premature rear wheel skid may also be caused by an incorrectly adjusted proportioning valve actuator assembly, or contaminated front or rear brake linings.

Prior to testing a proportioning valve for function, check that all tire pressures are correct. Also, ensure the front and rear brake linings are in satisfactory condition. **It is also necessary to verify that the brakes shoe assemblies on a vehicle being tested, are either original equipment manufacturers (OEM), or original replacement brake shoe assemblies meeting the OEM lining material specification. The vehicles brake system is not balanced for after market brake shoe assembly lining material.**

If both front and rear brakes check OK, proceed to verify that the actuator assembly for the height sensing proportioning valve is adjusted correctly. See Height Sensing Proportioning Valve in the Adjustment Section in this group of the service manual for the adjustment procedure. If the proportioning valve is adjusted correctly, proceed with the test procedure for the height sensing proportioning valve as follows:

(1) Remove the actuator assembly adjustment nut (Fig. 18). Remove the actuator assembly from the lever on the height sensing proportioning valve.

(2) Remove the chassis brake tube coming from the junction block from the front of the height sensing proportioning valve (Fig. 19). Remove the chassis brake tube going to the rear brakes from the back of the height sensing proportioning valve (Fig. 19).

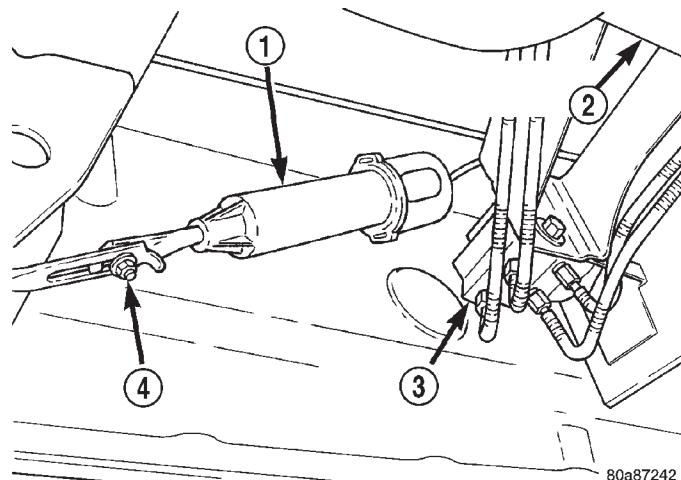


Fig. 18 Actuator Assembly Adjustment Nut

- 1 - ACTUATOR ASSEMBLY
- 2 - LEFT REAR FRAME RAIL
- 3 - HEIGHT SENSING PROPORTIONING VALVE
- 4 - ADJUSTMENT NUT

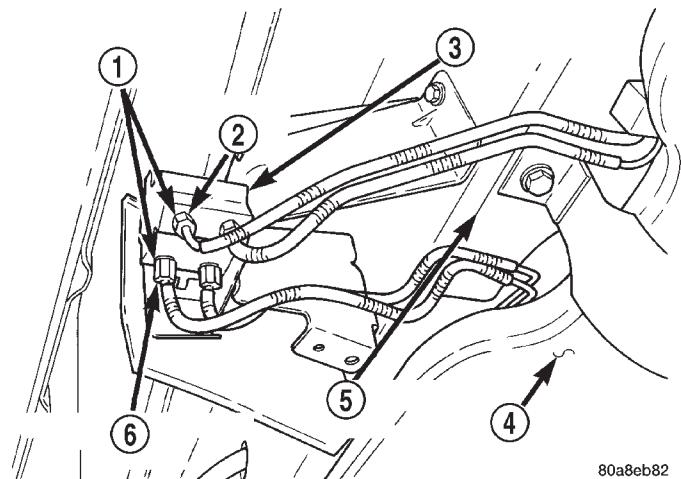


Fig. 19 Brake Tube Connections To Proportioning Valve

- 1 - REMOVE THESE CHASSIS BRAKE TUBES
- 2 - TO REAR BRAKE
- 3 - HEIGHT SENSING PROPORTIONING VALVE
- 4 - FUEL TANK
- 5 - LEFT FRAME RAIL
- 6 - FROM JUNCTION BLOCK

(3) Install the required fittings from Pressure Test Fittings, Special Tool 6833 (Fig. 20) into the inlet port of the proportioning valve assembly, from which the chassis brake line was removed. Install the removed chassis brake line into the Pressure Test Fitting (Fig. 20). Install the required fitting from Pressure Test Fittings, Special Tool 6833 into the required outlet port of the proportioning valve. Install the required fitting from Pressure Test Fit-

DIAGNOSIS AND TESTING (Continued)

tings, Special Tool 6833 into the required outlet port of the proportioning valve (Fig. 20). Then install the removed chassis brake line into the Pressure Test Fitting (Fig. 17).

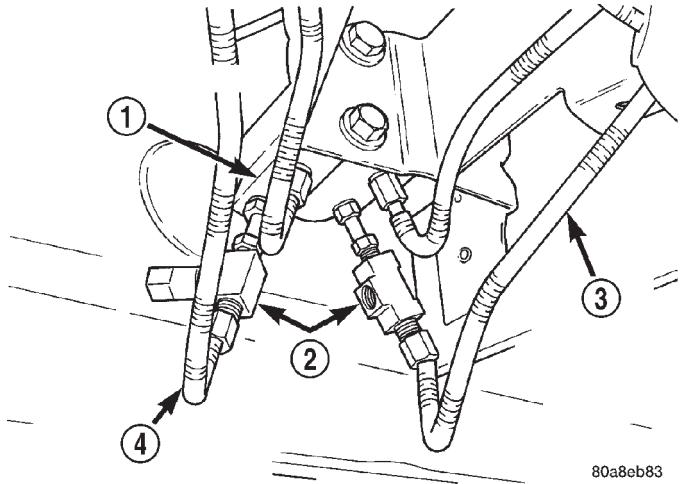


Fig. 20 Proportioning Valve Test Fitting Installation

- 1 – PROPORTIONING VALVE
- 2 – SPECIAL TOOL 6833
- 3 – CHASSIS BRAKE LINE FROM JUNCTION BLOCK
- 4 – CHASSIS BRAKE LINE TO REAR BRAKE

(4) Install a pressure gauge from Gauge Set, Special Tool C-4007-A into each pressure test fitting (Fig. 21). Bleed air out of hose from pressure test fittings to pressure gauges, at the pressure gauges (Fig. 21). Then bleed air out of the brake line being tested, at that rear wheel cylinder.

(5) With the aid of a helper, apply pressure to the brake pedal until a pressure of 6895 kPa (1000 psi) is obtained on the proportioning valve inlet gauge. Then based on the type of brake system the vehicle is equipped with and the pressure specification shown on the following table, compare the pressure reading on the outlet gauge to the specification. If outlet pressure at the proportioning valve is not within specification when required inlet pressure is obtained, replace the proportioning valve.

(6) Remove the pressure test fittings and pressure gauges from the proportioning valve.

(7) Install the chassis brake lines in the correct ports of the proportioning valve.

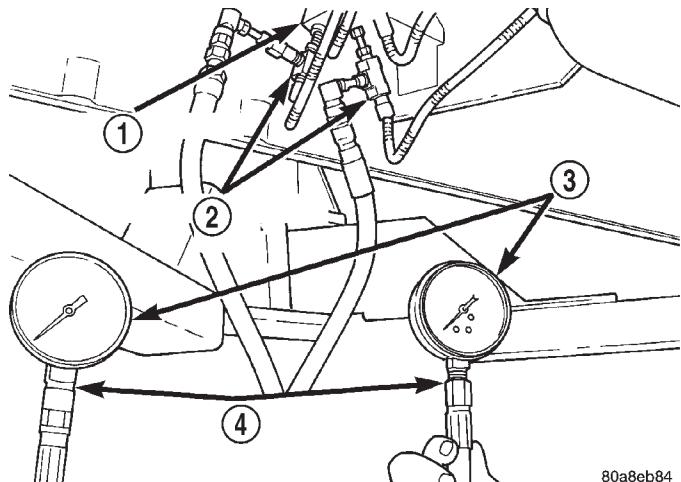


Fig. 21 Pressure Gauges Installed On Pressure Test Fittings

- 1 – PROPORTIONING VALVE
- 2 – SPECIAL TOOL 6833
- 3 – SPECIAL TOOL C-4007-A
- 4 – BLEED AIR FROM PRESSURE GAUGES HERE

(8) Install the pressure test fittings and pressure gauges in the opposite inlet and outlet port of the height sensing proportioning valve. Repeat steps 4 and 5 for the other proportioning valve.

(9) Remove the pressure test fittings and pressure gauges from the proportioning valve.

(10) Install the chassis brake lines in the correct ports of the proportioning valve.

(11) Install the actuator (Fig. 18) on the height sensing proportioning valve. Adjust the proportioning valve actuator. See Height Sensing Proportioning Valve in the Adjustment Section in this group of the service manual for the adjustment procedure.

(12) Bleed both rear hydraulic circuits at the rear brakes.

(13) Road test vehicle. Proportioning valve split point pressure conversion is 1 bar is equal to 14.5 psi.

DIAGNOSIS AND TESTING (Continued)

WHEEL BASE	DRIVE TRAIN	SALES CODE	BRAKE SYSTEM	SPLIT POINT	SLOPE	INLET PRESSURE PSI	OUTLET PRESSURE PSI
SWB	FWD	BRA-BGF	14" DISC/DRUM W/O ANTILOCK	VAR.	.30	1000 PSI	250-350 PSI
SWB	FWD	BRA+BGF BRB+BGF BRV+BGF	14",15",15"HD DISC/DRUM WITH ANTILOCK	25 BAR	.59	1000 PSI	660-780 PSI
LWB	FWD	BRA-BGF	14" DISC/DRUM W/O ANTILOCK	VAR.	.30	1000 PSI	250-350 PSI
LWB	FWD	BRA+BGF BRB+BGF BRV+BGF	14",15",15"HD DISC/DRUM WITH ANTILOCK	25 BAR	.59	1000 PSI	660-780 PSI
LWB	AWD	BRE+BGF	15" DISC/DISC WITH ANTILOCK	41 BAR	.36	1000 PSI	690-800 PSI

BRAKE ROTOR

Any servicing of the rotor requires extreme care to maintain the rotor within service tolerances to ensure proper brake action.

Excessive runout or wobble in a rotor can increase pedal travel due to piston knock-back. This increases guide pin sleeve wear due to the tendency of the caliper to follow the rotor wobble.

When diagnosing a brake noise or pulsation, the machined disc braking surface should be checked and inspected.

BRAKING SURFACE INSPECTION

Light braking surface scoring and wear is acceptable. If heavy scoring or warping is evident, the rotor must be refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

Excessive wear and scoring of the rotor can cause improper lining contact on the rotor's braking surface. If the ridges on the rotor are not removed before new brake shoes are installed, improper wear of the shoes will result.

If a vehicle has not been driven for a period of time, the rotor's braking surface will rust in the areas not covered by the brake shoes at that time. Once the vehicle is driven, noise and chatter from the disc brakes can result when the brakes are applied.

Some discoloration or wear of the rotor surface is normal and does not require resurfacing when linings are replaced. If cracks or burned spots are evident, the rotor must be replaced.

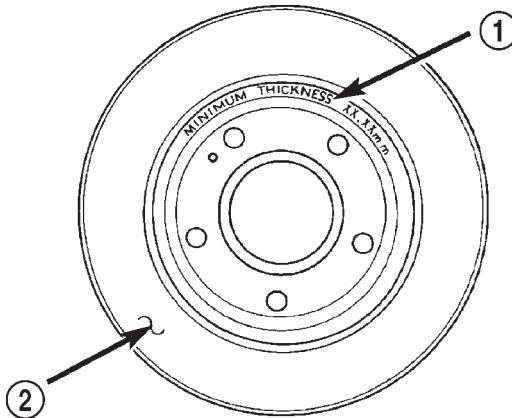
ROTOR MINIMUM THICKNESS

Measure rotor thickness at the center of the brake shoe contact surface. Replace the rotor if it is worn

below minimum thickness or if machining the rotor will cause its thickness to fall below specifications.

CAUTION: Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Minimum thickness specifications are cast on the rotor's unmachined surface (Fig. 22). Limits can also be found in the table at the end of this brake rotor information.



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Fig. 22 Minimum Brake Rotor Thickness Markings (Typical)

1 – ROTOR MINIMUM THICKNESS MARKING
2 – ROTOR

ROTOR THICKNESS VARIATION

Thickness variation in a rotor's braking surface can result in pedal pulsation, chatter and surge. This can also be caused by excessive runout in the rotor or the hub.

Rotor thickness variation measurements should be made in conjunction with measuring runout. Measure thickness of the brake rotor at 12 equal points

DIAGNOSIS AND TESTING (Continued)

around the rotor braking surface with a micrometer at a radius approximately 25 mm (1 inch) from edge of rotor (Fig. 23). If thickness measurements vary by more than 0.013 mm (0.0005 inch), the rotor should be refaced or replaced. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

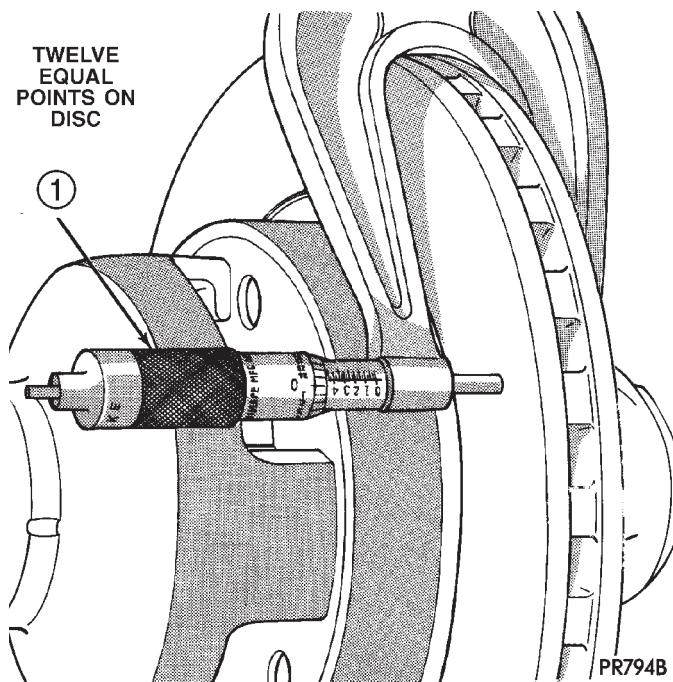


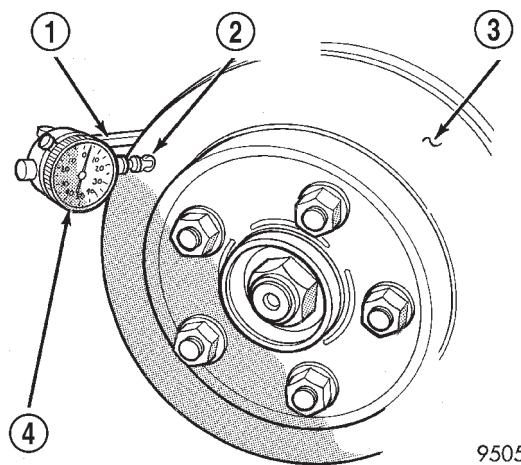
Fig. 23 Checking Rotor For Thickness

1 – CALIPER

ROTOR RUNOUT

On-vehicle rotor runout is the combination of the individual runout of the hub face and the runout of the rotor. (The hub and rotor runouts are separable). To measure rotor runout on the vehicle, first remove the tire and wheel assembly. Reinstall the wheel mounting nuts on the studs, tightening the rotor to the hub. Mount the Dial Indicator, Special Tool C-3339, with Mounting Adaptor, Special Tool SP-1910 on steering arm. The dial indicator plunger should contact braking surface of rotor approximately ten millimeters from edge of rotor (Fig. 24). Check lateral runout on both sides of the rotor, marking the low and high spots on both. Runout limits can be found in the table at the end of this brake rotor information.

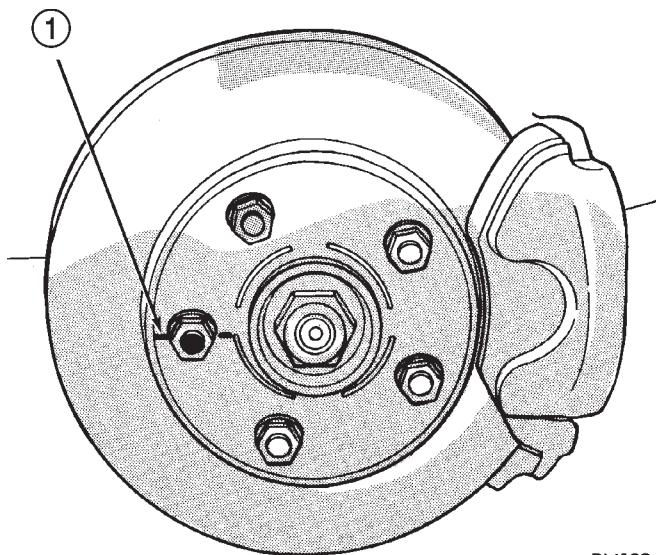
If runout is in excess of the specification, check the lateral runout of the hub face. Before removing the rotor from the hub, place a chalk mark across both the rotor and the one wheel stud closest to where the high runout measurement was taken. This way, the original mounting spot of the rotor on the hub is indexed (Fig. 25).



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Fig. 24 Checking Rotor Runout

1 – SPECIAL TOOL SP-1910
2 – 10 MILLIMETERS FROM EDGE
3 – DISC SURFACE
4 – SPECIAL TOOL C-3339



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Fig. 25 Marking Rotor and Wheel Stud

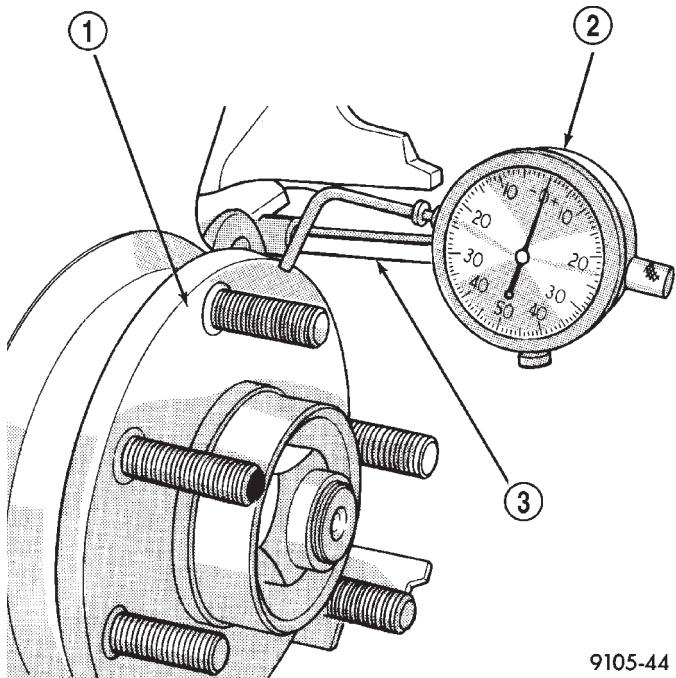
1 – CHALK MARK

Remove the rotor from the hub.

NOTE: Clean the hub face surface before checking runout. This provides a clean surface to get an accurate indicator reading.

Mount Dial Indicator, Special Tool C-3339, and Mounting Adaptor, Special Tool SP-1910, to the steering knuckle. Position the indicator stem so it contacts the hub face near the outer diameter. Care must be taken to position stem outside of the stud circle, but inside of the chamfer on the hub rim (Fig. 26).

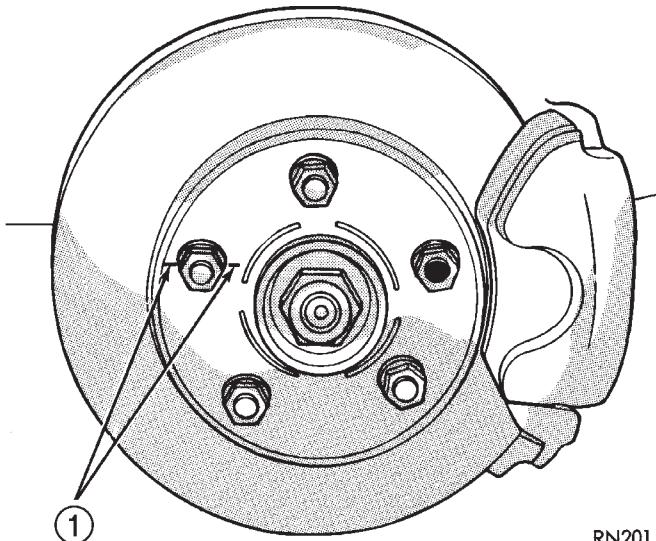
DIAGNOSIS AND TESTING (Continued)

**Fig. 26 Checking Hub Runout**

- 1 – HUB SURFACE
 2 – SPECIAL TOOL C-3339
 3 – SPECIAL TOOL SP-1910

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chalk marks on the rotor with a wheel mounting stud, two studs apart from the original stud (Fig. 27). Tighten nuts in the proper sequence and torque to specifications.

**Fig. 27 Index Rotor And Wheel Stud**

- 1 – CHALK MARK

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Hub runout should not exceed 0.03 mm (0.0012 inch). If runout exceeds this specification, the hub must be replaced. Refer to the SUSPENSION group in this service manual for the replacement procedure.

If the hub runout does not exceed this specification, install the rotor back on the hub, aligning the

Recheck brake rotor runout to see if the runout is now within specifications.

If runout is not within specifications, reface or replace the brake rotor. Refer to SERVICE PROCEDURES in this section of this group for information on brake rotor machining.

BRAKE ROTOR LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Runout*	Rotor Micro Finish
Front Rotor	23.87–24.13 mm 0.939-0.949 in.	22.4 mm 0.881 in.	0.013 mm 0.0005 in.	0.103 mm 0.004 in.	15-80 RMS
Rear Rotor	12.25–12.75 mm 0.482 -0.502 in.	11.25 mm 0.443 in.	0.013 mm 0.0005 in.	0.14 mm 0.0055 in.	15-80 RMS

* TIR Total Indicator Reading (Measured On Vehicle)

ADJUSTER REAR DRUM BRAKE (AUTOMATIC)

The rear drum brakes on this vehicle automatically adjust, when required, during the normal operation of the vehicle every time the brakes are applied. Use the following procedure to test the operation of the automatic adjuster.

Place the vehicle on a hoist with a helper in the driver's seat to apply the brakes. Remove the access

plug from the adjustment hole in each brake support plate to provide visual access of the brake adjuster star wheel.

To eliminate the condition where maximum adjustment of the rear brake shoes does not allow the automatic adjuster to operate when tested, back the star wheel off approximately 30 notches. It will be neces-

DIAGNOSIS AND TESTING (Continued)

sary to hold the adjuster lever away from the star wheel to permit this adjustment.

Have the helper apply the brakes. Upon application of the brake pedal, the adjuster lever lever should move down, turning the adjuster star wheel. Thus, a definite rotation of the adjuster star wheel can be observed if the automatic adjuster is working properly. If one or more adjusters do not function properly, the respective drum must be removed for adjuster servicing.

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts.

Swollen rubber parts indicate the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If brake fluid is contaminated, drain and thoroughly flush system. Replace master cylinder, proportioning valve, caliper seals, wheel cylinder seals, Antilock Brakes hydraulic unit and all hydraulic fluid hoses.

BRAKE LAMP SWITCH

NOTE: Before proceeding with this diagnostic test, verify the adjustment of the brake lamp switch to rule out misadjustment. Refer to ADJUSTMENTS in this service manual group.

If the electrical circuit has been tested and the brake lamp switch is suspected of being faulty, it can be tested using the following method.

(1) Remove the switch from the vehicle. Refer to REMOVAL AND INSTALLATION in this section for the proper procedure.

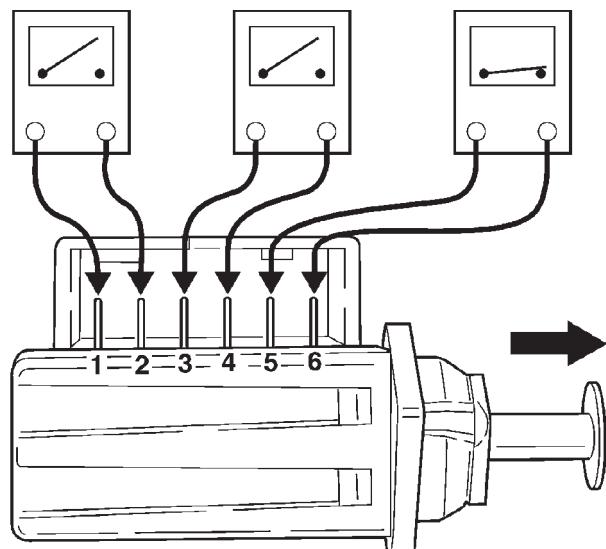
(2) With the switch in the released position (plunger extended), use an ohmmeter to test each of the three internal switches as shown (Fig. 28). You should achieve the results as listed in the figure.

(3) Gently push the plunger on the brake lamp switch in until it stops.

(4) With the switch in the depressed position (plunger pushed in), use an ohmmeter to test each of the three internal switches as shown (Fig. 29). You should achieve the results as listed in the figure.

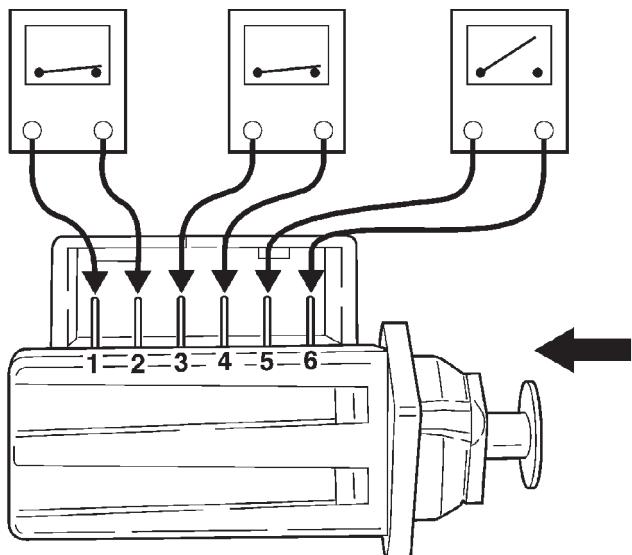
If you do not achieve the results as listed in both figures, the switch is faulty and must be replaced.

(5) Install the switch in the vehicle. Refer to REMOVAL AND INSTALLATION in this section for the proper procedure.



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Fig. 28 Switch Test - Released Position



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Fig. 29 Switch Test - Depressed Position

SERVICE PROCEDURES

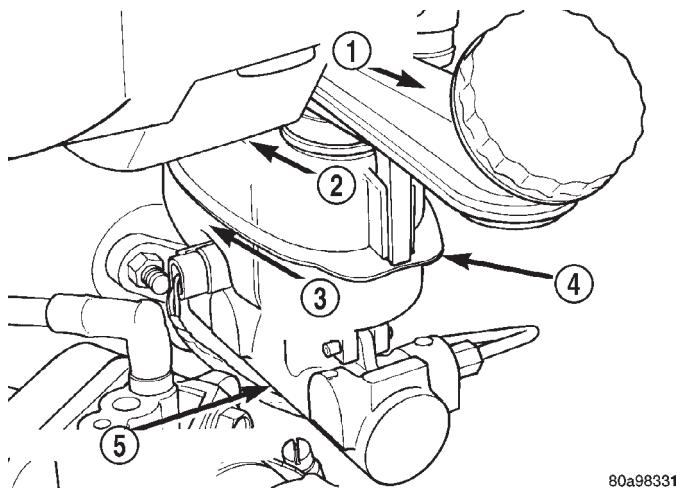
MASTER CYLINDER FLUID LEVEL CHECK

Check master cylinder reservoir fluid level a minimum of twice annually.

Master cylinder reservoirs are marked with the words FULL and ADD to indicate proper brake fluid fill level of the master cylinder (Fig. 30).

If necessary, add brake fluid to bring the level to the bottom of the FULL mark on the side of the master cylinder fluid reservoir. **When filling master cylinder fluid reservoir do not fill the filler neck of the fluid reservoir (Fig. 30) with brake fluid.**

SERVICE PROCEDURES (Continued)

**Fig. 30 Master Cylinder Fluid Level Marks**

- 1 – FILLER NECK
- 2 – FULL MARK
- 3 – ADD MARK
- 4 – FLUID RESERVOIR
- 5 – MASTER CYLINDER ASSEMBLY

Use only Mopar® brake fluid or an equivalent from a sealed container. Brake fluid must conform to DOT 3, specifications.

DO NOT use brake fluid with a lower boiling point, as brake failure could result during prolonged hard braking.

Use only brake fluid that was stored in a tightly-sealed container.

DO NOT use petroleum-based fluid because seal damage will result. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid etc.

BASE BRAKE BLEEDING

NOTE: This bleeding procedure is only for the vehicle's base brakes hydraulic system. For bleeding the antilock brakes hydraulic system, refer to the Antilock Brake System Bleeding procedure in the Antilock Brake System section of this service manual.

PRESSURE BLEEDING PROCEDURE

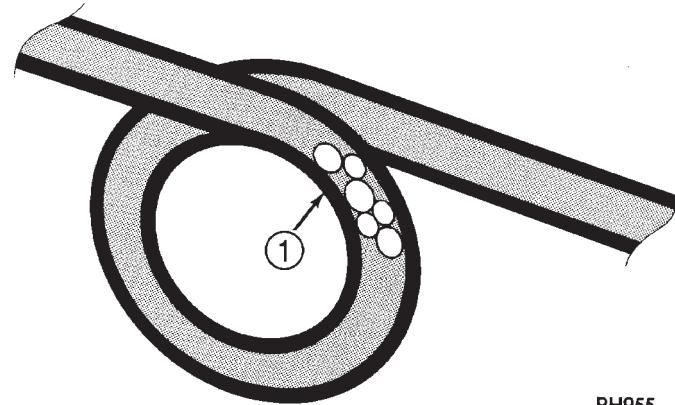
CAUTION: Before removing the master cylinder cover, thoroughly clean the cover and master cylinder fluid reservoir to prevent dirt and other foreign matter from dropping into the master cylinder fluid reservoir.

CAUTION: Use bleeder tank Special Tool C-3496-B with adapter Special Tool 6921 to pressurize the hydraulic system for bleeding.

CAUTION: When pressure bleeding the brakes hydraulic system the fluid reservoir filler neck must be removed from the master cylinder fluid reservoir. Failure to remove the filler neck from the fluid reservoir, may result in the filler neck separating from the fluid reservoir when the hydraulic system is pressurized.

Follow pressure bleeder manufacturer's instructions, for use of pressure bleeding equipment.

When bleeding the brake system, some air may be trapped in the brake lines or valves far upstream, as much as ten feet from the bleeder screw (Fig. 31). Therefore, it is essential to have a fast flow of a large volume of brake fluid when bleeding the brakes to ensure all the air gets out.

**Fig. 31 Trapped Air In Brake Fluid Line**

- 1 – TRAPPED AIR

(1) Remove the filler neck from the master cylinder fluid reservoir.

(2) Install the Adapter Master Cylinder Pressure Bleed Cap, Special Tool 6921 on the fluid reservoir of the master cylinder (Fig. 32). Attach the fluid hose from the pressure bleeder to the fitting on Special Tool 6921.

(3) Attach a clear plastic hose to the bleeder screw at one wheel and feed the hose into a clear jar containing fresh brake fluid.

NOTE: The following wheel sequence should be used when bleeding the brake hydraulic system. The use of this wheel sequence will ensure adequate removal of all trapped air from the brake hydraulic system.

SERVICE PROCEDURES (Continued)

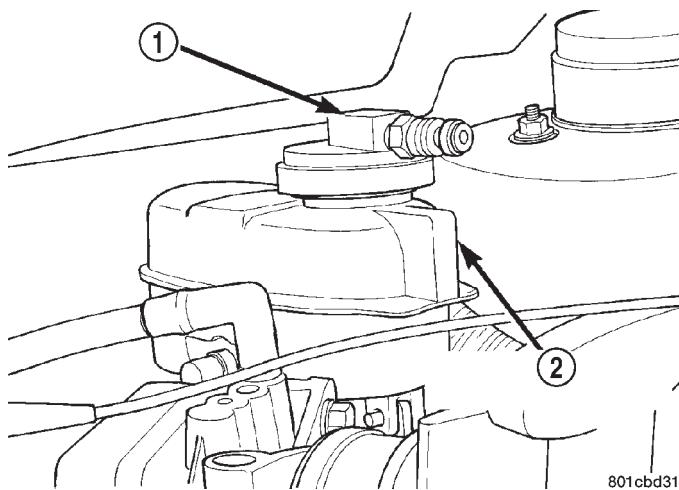


Fig. 32 Pressure Bleeding Cap Installed On Master Cylinder

1 – SPECIAL TOOL 6921

2 – MASTER CYLINDER FLUID RESERVOIR

- Left Rear Wheel
- Right Front Wheel
- Right Rear Wheel
- Left Front Wheel

(4) Open the left rear wheel bleeder screw at least **one full turn** or more to obtain an adequate flow of brake fluid (Fig. 33).

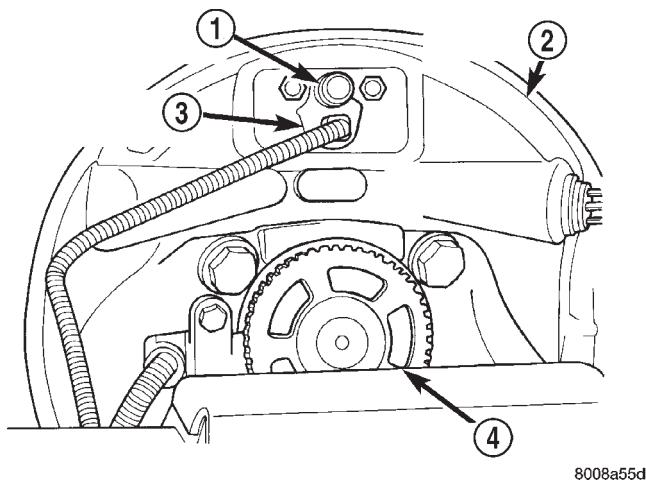


Fig. 33 Rear Wheel Cylinder Bleeder Screw

1 – BLEEDER SCREW

2 – REAR BRAKE SUPPORT PLATE

3 – REAR BRAKE WHEEL CYLINDER

4 – TONE WHEEL

CAUTION: Just cracking the bleeder screw often restricts fluid flow, and a slow, weak fluid discharge will **NOT** get all the air out.

(5) After 4 to 8 ounces of brake fluid has been bled through the hydraulic system, and an air-free flow is

maintained in the hose and jar, this will indicate a good bleed of the hydraulic system has been obtained.

(6) Repeat the procedure at all the other remaining bleeder screws. Then check the pedal for travel. If pedal travel is excessive or has not been improved, enough fluid has not passed through the system to expel all the trapped air. Be sure to monitor the fluid level in the pressure bleeder, so it stays at a proper level so air will not enter the brake system through the master cylinder.

(7) Perform a final adjustment of the rear brake shoes and then test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

BLEEDING WITHOUT A PRESSURE BLEEDER

NOTE: Correct manual bleeding of the brakes hydraulic system will require the aid of a helper.

NOTE: To adequately bleed the brakes using the manual bleeding procedure the rear brakes must be correctly adjusted. Prior to the manual bleeding of the brake hydraulic system, correctly adjust the rear brakes.

NOTE: The following wheel sequence should be used when bleeding the brake hydraulic system. The use of this wheel sequence will ensure adequate removal of all trapped air from the brake hydraulic system.

- Left Rear Wheel
- Right Front Wheel
- Right Rear Wheel
- Left Front Wheel

(1) Pump the brake pedal three or four times and hold it down before the bleeder screw is opened.

(2) Push the brake pedal toward the floor and hold it down. Then open the left rear bleeder screw at least 1 full turn. When the bleeder screw opens the brake pedal will drop all the way to the floor.

(3) Release the brake pedal only **after** the bleeder screw is closed.

(4) Repeat steps 1 through 3, four or five times, at each bleeder screw in the required sequence. This should pass a sufficient amount of fluid to expel all the trapped air from the brake system. Be sure to monitor the fluid level in the master cylinder, so it stays at a proper level so air will not enter the brake system through the master cylinder.

(5) Perform a final adjustment of the rear brake shoes and then test drive vehicle to be sure brakes are operating correctly and that pedal is solid.

SERVICE PROCEDURES (Continued)

MASTER CYLINDER BLEEDING

CAUTION: When clamping master cylinder in vise, only clamp master cylinder by its mounting flange, do not clamp on primary piston, sealout or body of master cylinder.

- Clamp the master cylinder in a vise using only the mounting flange (Fig. 34).

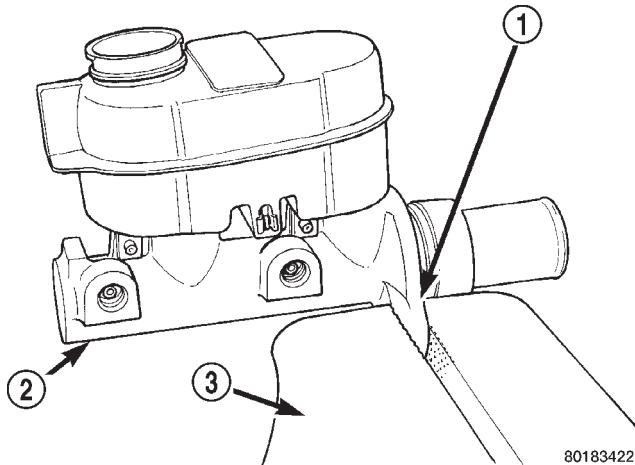


Fig. 34 Master Cylinder Mounted In Vise

- 1 – MASTER CYLINDER MOUNTING FLANGE
2 – MASTER CYLINDER ASSEMBLY
3 – VISE

NOTE: Two different size bleeding tubes are used depending on which type of master cylinder the vehicle is equipped with. Vehicles equipped with traction control use a center port master cylinder with a 6 millimeter diameter brake tube. Vehicles not equipped with traction control use a compensating port master cylinder using a standard 3/16 inch diameter brake tube. Be sure the correct size bleeding tubes are used when bleeding the master cylinder.

- Install the Bleeding Tubes, Special Tool 6920, for a non-traction control master cylinder or Special Tool 8129 for a traction control master cylinder on the master cylinder (Fig. 53). Position bleeding tubes so the outlets of bleeding tubes will be below surface of brake fluid when reservoir is filled to its proper level.

(3) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(4) Using a wooden dowel, depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled from master cylinder.

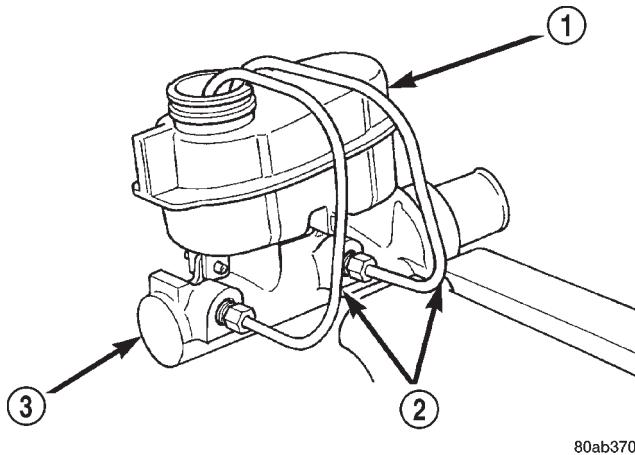


Fig. 35 Bleed Tubes Installed On Master Cylinder

- 1 – FLUID RESERVOIR
2 – SPECIAL TOOL 6920 OR 8129
3 – MASTER CYLINDER

- Remove bleeding tubes from master cylinder outlet ports, and then plug outlet ports and install fill cap on reservoir.

(6) Remove master cylinder from vise.

(7) Install the filler cap from the master cylinder filler neck, on the master cylinder fluid reservoir.

(8) Install the master cylinder assembly on the power brake vacuum booster.

NOTE: Note: It is not necessary to bleed the ABS hydraulic control unit (HCU) after replacing the master cylinder. But, the base brake hydraulic system must be bled to ensure no air is entered the hydraulic system when the master cylinder was removed.

BRAKE TUBE REPAIR

CAUTION: When repairing brake chassis lines or flex hoses, the correct fasteners must be used to attach the routing clips or hoses to the front suspension cradle. The fasteners used to attach components to the front suspension cradle have an anti-corrosion coating due to the suspension cradle being made of aluminum. Only Mopar replacement fasteners with the required anti-corrosion coating are to be used if a replacement fastener is required when installing a brake chassis line or flex hose.

Only double wall 4.75mm (3/16 in.) steel tubing with Al-rich/ZW-AC alloy coating and the correct tube nuts are to be used for replacement of a hydraulic brake tube.

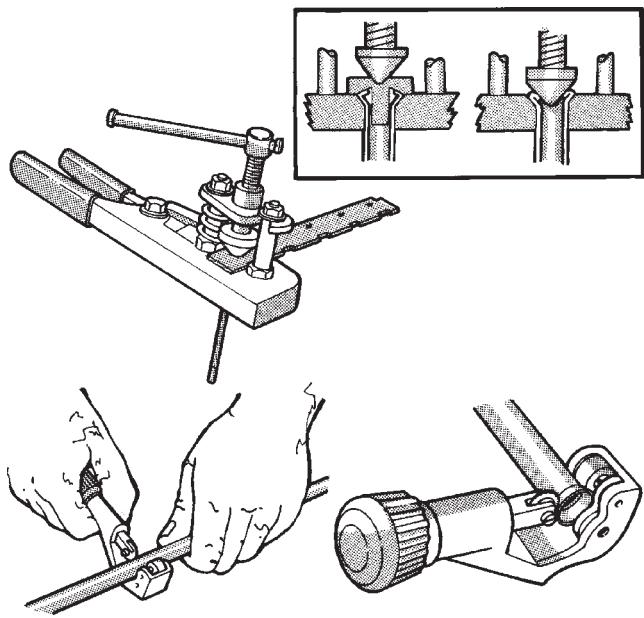
SERVICE PROCEDURES (Continued)

NOTE: On vehicles equipped with traction control, the primary and secondary hydraulic tubes between the master cylinder and the hydraulic control unit are 6 mm (15/64 in.). These tubes are also coated with the Al-rich/ZW-AC alloy and must be replaced with tubes having the same anti-corrosion coating. Be sure the correct tube nuts are used for the replacement of these hydraulic brake tubes.

Care should be taken when repairing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

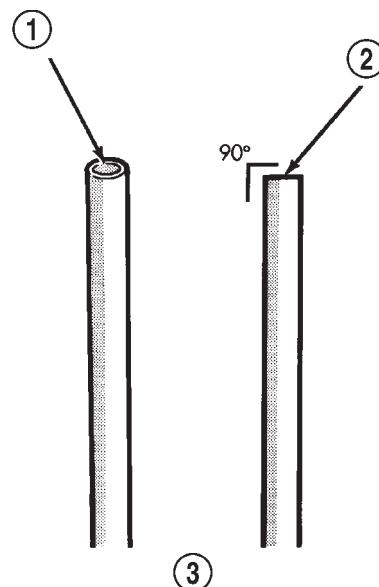
If the primary or secondary brake line from the master cylinder to the ABS Hydraulic Control Unit, or the flexible brake lines between the hydraulic control unit and the proportioning valve require replacement **only** the original factory brake lines containing a flexible section can be used. This is required due to the movement of the front suspension cradle while the vehicle is in motion.

Using Tubing Cutter, Special Tool C-3478-A or equivalent, cut off damaged seat or tubing (Fig. 36). Ream out any burrs or rough edges showing on inside of tubing (Fig. 37). This will make the ends of tubing square (Fig. 37) and ensure better seating of flared end tubing. **PLACE TUBE NUT ON TUBING BEFORE FLARING THE TUBING.**



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Fig. 36 Cutting And Flaring Of Brake Fluid Tubing



9205-175

Fig. 37 Brake Fluid Tube Preparation For Flaring

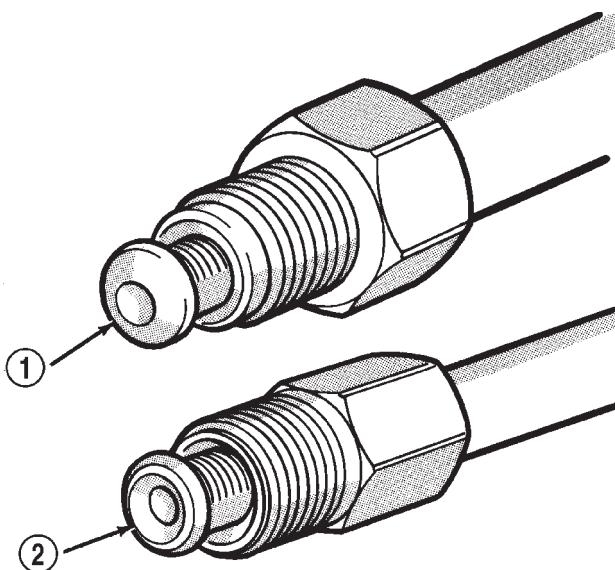
- 1 - BE SURE ALL BURRS ARE REMOVED FROM INSIDE OF TUBING
- 2 - BE SURE END OF TUBING IS SQUARE BEFORE FLARING TUBE
- 3 - HYDRAULIC BRAKE LINE TUBING

DOUBLE INVERTED TUBING FLARES

To make a double inverted tubing flare (Fig. 38) and (Fig. 39). Open handles of Flaring Tool, Special Tool C-4047 or equivalent. Then rotate jaws of tool until the mating jaws of tubing size are centered between vertical posts on tool. Slowly close handles with tubing inserted in jaws but do not apply heavy pressure to handle as this will lock tubing in place.

Place gauge (Form A) on edge over end of brake tubing. Push tubing through jaws until end of tubing contacts the recessed notch in gauge matching the tubing size. Squeeze handles of flaring tool and lock tubing in place. Place 3/16 inch plug of gauge (A) down in end of tubing. Swing compression disc over gauge and center tapered flaring screw in recess of disc. Screw in until plug gauge has seated on jaws of flaring tool. This action has started to invert the extended end of the tubing. Remove gauge and continue to screw down until tool is firmly seated in tubing. Remove tubing from flaring tool and inspect seat. Refer to tube routing diagrams for proper brake tube routing and clip locations. Replace any damaged tube routing clips.

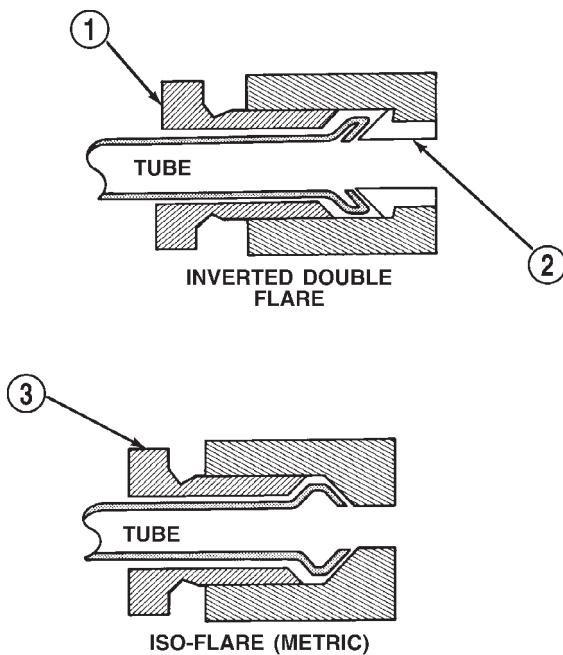
SERVICE PROCEDURES (Continued)



9205-174

Fig. 38 Hydraulic Brake Tubing Flare Styles

- 1 – ISO-STYLE FLARE
2 – DOUBLE INVERTED-STYLE FLARE



9105-30

Fig. 39 Inverted Double Wall Flare And ISO Flare Tubing Connections

- 1 – INVERTED FLARE TUBE NUT
2 – SEAT
3 – ISO FLARE TUBE NUT

ISO TUBING FLARES

CAUTION: All ISO style tubing flares (Fig. 38) and (Fig. 39) are of metric dimensions. When performing any service procedures on vehicles using ISO style tubing flares, metric size tubing of 4.75 mm **MUST** be used with metric ISO tube flaring equipment.

To create a (metric) ISO style tubing flare, Use Snap-On Flaring Tool TFM-428, or equivalent. See (Fig. 40) and proceed with the steps listed below. **Be sure to place the tubing nut on the tube before flaring the tubing.**

(1) Carefully prepare the end of the tubing to be flared. Be sure the end of the tubing to be flared is square and all burrs on the inside of the tubing are removed (Fig. 37). **This preparation is essential to obtain the correct form of a (metric) ISO tubing flare.**

(2) Open jaws of the Flaring Tool. Align the mating size jaws of the flaring tool around the size of the tubing to be flared. Close the jaws of the Flaring Tool around the tubing to keep it from sliding out of the flaring tool, but do not lock the tubing in place. See (Fig. 40)

(3) Position the tubing in the jaws of the Flaring Tool so that it is flush with the top surface of the flaring tool bar assembly. (Fig. 40)

(4) Install the correct size adaptor for the brake tubing being flared, on the feed screw of the yoke assembly. Center the yoke and adapter over the end of the tubing. Apply lubricant to the adapter area that contacts brake tubing. Making sure the adapter pilot is fully inserted in the end of the brake tubing. Screw in the feed screw of the yoke assembly until the adaptor has seated squarely on the surface of the bar assembly (Fig. 40). This process has created the (metric) ISO tubing flare.

BRAKE ROTOR MACHINING

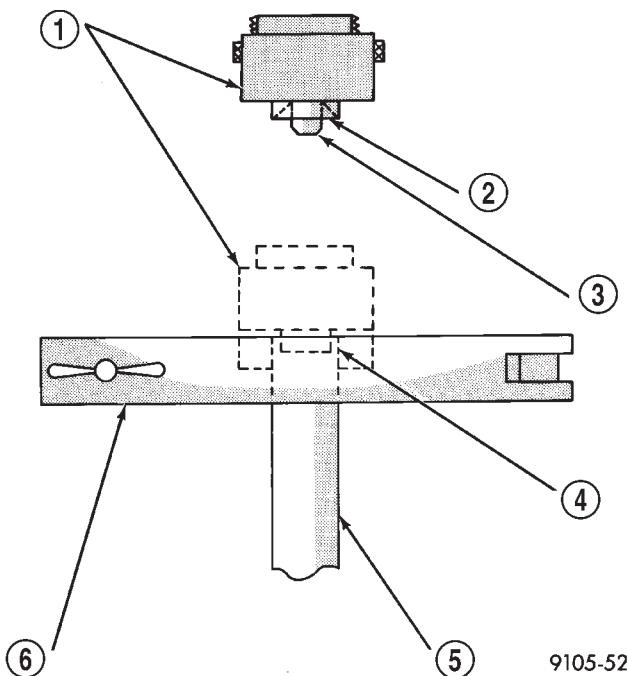
NOTE: Refacing the rotor is not required each time the brake pads are replaced, only when the need is foreseen.

Any servicing of the rotor requires extreme care to maintain the rotor within service tolerances to ensure proper brake action.

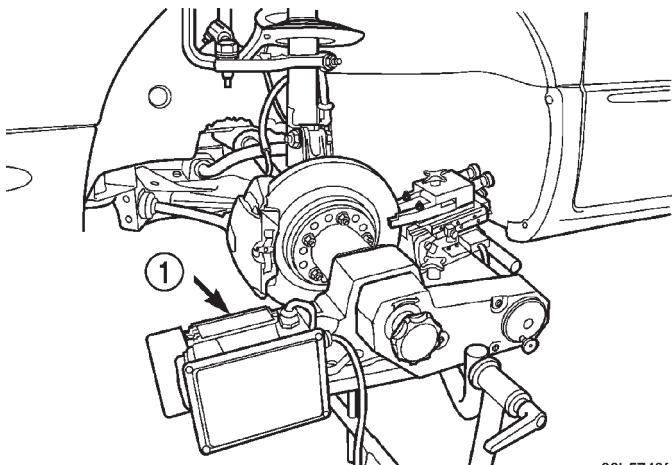
If the rotor surface is deeply scored or warped, or there is a complaint of brake roughness or brake pedal pulsation, the rotor should be refaced using a hub-mounted on-car brake lathe (Fig. 41), or replaced.

The use of a hub-mounted on-car brake lathe is highly recommended to eliminate the possibility of excessive runout. It trues the brake rotor to the vehicle's hub and bearing.

SERVICE PROCEDURES (Continued)

**Fig. 40 Brake Tubing ISO Flaring Process**

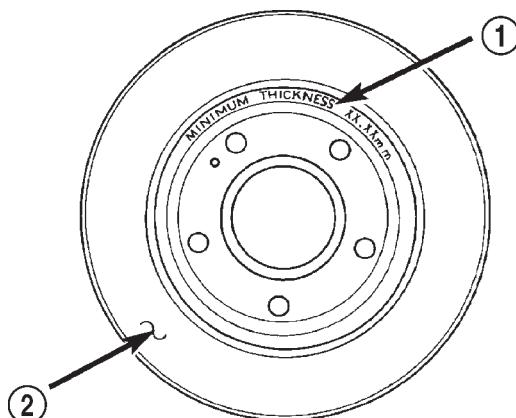
- 1 – ADAPTER
- 2 – LUBRICATE HERE
- 3 – PILOT
- 4 – FLUSH WITH BAR
- 5 – TUBING
- 6 – BAR ASSEMBLY

**Fig. 41 On-Car Brake Lathe**

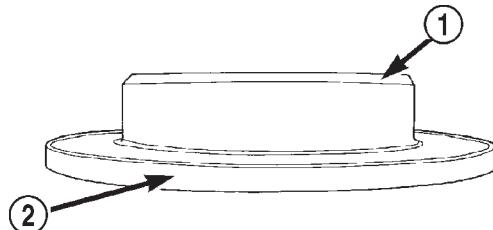
- 1 – ON-CAR BRAKE LATHE

NOTE: All rotors have markings for minimum allowable thickness cast on an un-machined surface of the rotor (Fig. 42) (Fig. 43).

Minimum allowable thickness is the minimum thickness which the brake rotor machined surface may be cut to.

**Fig. 42 Front Brake Rotor Minimum Thickness Markings**

- 1 – ROTOR MINIMUM THICKNESS MARKING
- 2 – ROTOR

**Fig. 43 Rear Brake Rotor Minimum Thickness Markings**

- 1 – ROTOR MINIMUM THICKNESS AND DRUM MAXIMUM DIAMETER SPECIFICATIONS ARE SHOWN ON THIS SURFACE
- 2 – REAR ROTOR

CAUTION: Do not machine the rotor if it will cause the rotor to fall below minimum thickness.

Before installation, verify the brake rotor face and the hub adapters are free of any chips, rust, or contamination.

When mounting and using the brake lathe, strict attention to the brake lathe manufacturer's operating instructions is required.

Machine both sides of the brake rotor at the same time. Cutting both sides at the same time minimizes the possibility of a tapered or uneven cut.

SPECIFICATIONS AND LIMITS

When refacing a rotor, the required TIR and thickness variation limits MUST BE MAINTAINED. Extreme care in the operation of rotor turning equipment is required.

SERVICE PROCEDURES (Continued)

BRAKE ROTOR LIMITS

Braking Rotor	Rotor Thickness	Minimum Rotor Thickness	Rotor Thickness Variation	Rotor Runout*	Rotor Micro Finish
Front Rotor	23.87-24.13 mm 0.939-0.949 in.	22.4 mm 0.881 in.	0.013 mm 0.0005 in.	0.103 mm 0.004 in.	15-80 RMS
Rear Rotor	12.25-12.75 mm 0.482 -0.502 in.	11.25 mm 0.443 in.	0.013 mm 0.0005 in.	0.14 mm 0.0055 in.	15-80 RMS

* TIR Total Indicator Reading (Measured On Vehicle)

BRAKE DRUM MACHINING

Measure the runout and diameter of the rear brake using only accurate measuring equipment. There should be no variation in the drum diameter greater than 0.090 mm (0.004 inch). Drum runout should not exceed 0.15 mm (0.006 inch) out of round. If the drum runout or diameter variation exceed these values the drum should be refaced. For best results in eliminating the irregularities that cause brake roughness and surge, the amount of material removed during a single cut should be limited to 0.13 mm (0.005 inch). When the entire braking surface has been cleaned, a final cut of 0.0254 mm (0.001 inch) will assure a good drum surface providing the equipment used is capable of the precision required for resurfacing brake drums. Deeper cuts are permissible for the sole purpose of removing deep score marks. **Do not reface more than 1.52 mm (0.060 inch) over the standard drum diameter.**

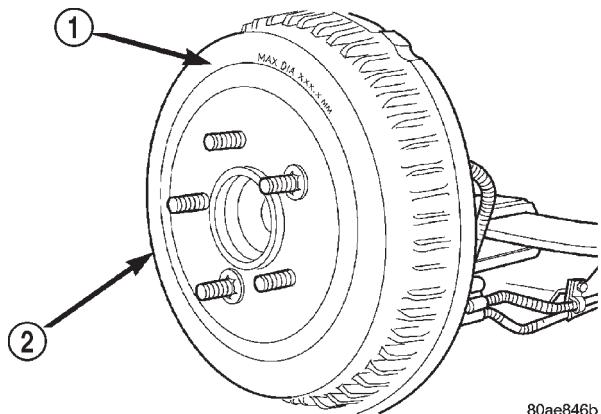
All drums will show markings of maximum allowable diameter (Fig. 44). For example, a drum will have a marking of MAX. DIA. 251.55 mm (9.90 inch). This marking includes 0.76 mm (0.030 inch) for allowable drum wear beyond the recommended 1.52 mm (0.060 inch) of drum refacing.

PARKING BRAKE AUTOMATIC ADJUSTER MECHANISM RELEASE

The parking brake lever (pedal) mechanism used in this vehicle is designed so that the automatic adjuster is not required to be locked out when servicing the parking brake lever (pedal) or the parking brake cables.

This parking brake lever (pedal) mechanism is designed so that the adjuster mechanism will rotate only half a turn when the tension is released from the parking brake cable. This eliminates the requirement to lock out the automatic adjuster when servicing the parking brake lever (pedal) mechanism and cables.

Use the following procedure to release the tension from the parking brake cables and the automatic



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Fig. 44 Rear Brake Drum Maximum Diameter Identification

- 1 – MAXIMUM DIAMETER OF BRAKE DRUM SHOWN ON THIS SURFACE
2 – BRAKE DRUM

adjuster in the parking brake lever (pedal) mechanism.

(1) Grasp the exposed section of the front parking brake cable and pull rearward on it. While holding the park brake in this position, install a pair of locking pliers on the front parking brake cable just rearward of the second body outrigger bracket (Fig. 45).

(2) Remove the left rear and intermediate parking brake cables from the parking brake cable equalizer (Fig. 46).

(3) Remove the equalizer from the front parking brake cable.

(4) Remove the locking pliers from the front parking brake cable. This will allow the adjuster in the parking brake lever (pedal) mechanism to rotate around to its stop. This will remove the tension from the adjuster and front park brake cable.

AUTOMATIC ADJUSTER RESET

(1) Grasp the exposed section of the front parking brake cable and pull rearward on it. While holding the park brake in this position, install a pair of lock-

SERVICE PROCEDURES (Continued)

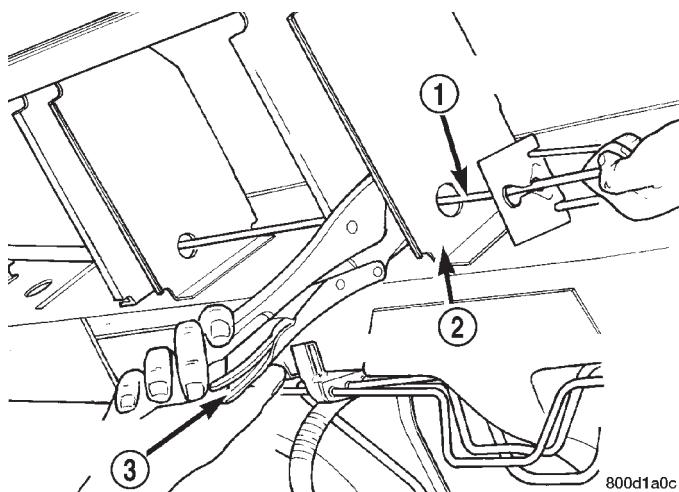


Fig. 45 Locking Out Automatic Adjuster

- 1 – PARK BRAKE CABLE
- 2 – REAR BODY OUTRIGGER BRACKET
- 3 – LOCKING PLIERS

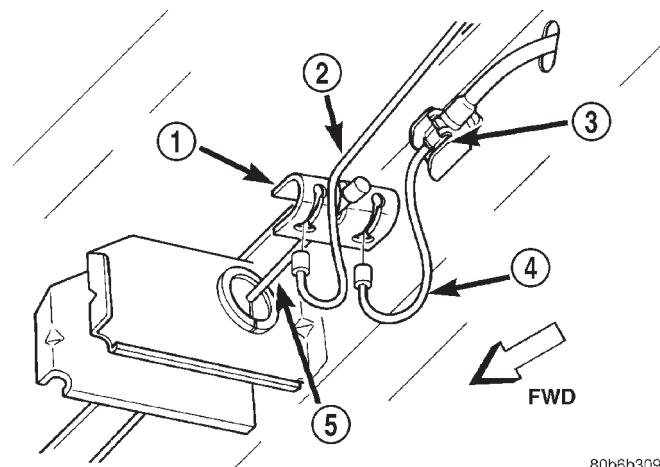


Fig. 46 Parking Brake Cable Attachment To Equalizer

- 1 – EQUALIZER
- 2 – LEFT REAR PARKING BRAKE CABLE
- 3 – LOCKING NUT
- 4 – INTERMEDIATE PARKING BRAKE CABLE
- 5 – FRONT PARKING BRAKE CABLE

ing pliers on the front parking brake cable just rearward of the second body outrigger bracket (Fig. 45).

(2) Install the equalizer on the front parking brake cable.

(3) Install the left rear and intermediate park brake cable in the correct location on the parking brake cable equalizer (Fig. 46).

(4) Remove the locking pliers from the front parking brake cable. This will allow the adjuster in the park brake lever (pedal) mechanism to tension the park brake cables.

(5) Apply and release the parking brake lever (pedal) one time. This will seat the parking brake cables and allow the auto adjuster in the parking brake lever (pedal) mechanism to correctly tension the parking brake cables.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

WARNING: ALTHOUGH FACTORY INSTALLED BRAKE LININGS ARE MADE FROM ASBESTOS FREE MATERIALS, SOME AFTER MARKET BRAKE LINING MAY CONTAIN ASBESTOS. THIS SHOULD BE TAKEN INTO ACCOUNT WHEN SERVICING A VEHICLE'S BRAKE SYSTEM, WHEN AFTERMARKET BRAKE LININGS MAY HAVE BEEN INSTALLED ON THE VEHICLE. ALWAYS WEAR A RESPIRATOR WHEN CLEANING BRAKE COMPONENTS AS ASBESTOS CAN CAUSE SERIOUS BODILY HARM SUCH AS ASBESTOSIS AND OR CANCER. NEVER CLEAN BRAKE COMPONENTS BY USING COMPRESSED AIR, USE ONLY A VACUUM CLEANER SPECIFICALLY DESIGNED FOR THE REMOVAL OF BRAKE DUST. IF A VACUUM CLEANER IS NOT AVAILABLE, CLEAN BRAKE PARTS USING ONLY WATER-DAMPENED SHOP TOWELS. DO NOT CREATE BRAKE LINING DUST BY SANDING BRAKE LININGS WHEN SERVICING A VEHICLE. DISPOSE OF ALL DUST AND DIRT SUSPECTED OF CONTAINING ASBESTOS FIBERS USING ONLY SEALED AIR-TIGHT BAGS OR CONTAINERS. FOLLOW ALL RECOMMENDED SAFETY PRACTICES PRESCRIBED BY THE OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION (OSHA) AND THE ENVIRONMENTAL PROTECTION AGENCY (EPA), FOR HANDLING AND DISPOSAL OF PRODUCTS CONTAINING ASBESTOS.

CAUTION: During service procedures, grease or any other foreign material must be kept off brake shoe assemblies, and braking surfaces of brake rotor or drum, and external surfaces of hub and bearing assembly.

CAUTION: Handling of brake rotors and calipers must be done in such a way as to avoid damage to the rotor and scratching or nicking of brake lining on the brake shoes.

REMOVAL AND INSTALLATION (Continued)

CAUTION: At no time when servicing a vehicle, can a sheet metal screw, bolt or other metal fastener be installed in the shock tower to take the place of an original plastic clip. Also, NO holes can be drilled into the front shock tower in the area shown in (Fig. 47), for the installation of any metal fasteners into the shock tower. Because of the minimum clearance in this area (Fig. 47), installation of metal fasteners could damage the coil spring coating and lead to a corrosion failure of the spring. If a plastic clip is missing, or is lost or broken during servicing a vehicle, replace only with the equivalent part listed in the Mopar parts catalog.

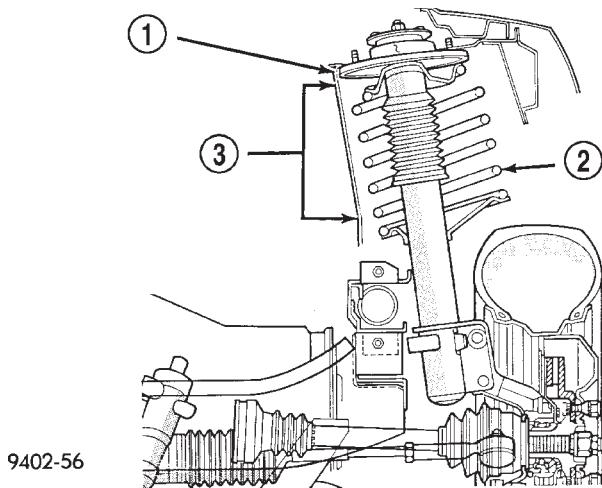


Fig. 47 Shock Tower To Spring Minimum Clearance Area

- 1 – SHOCK TOWER
- 2 – COIL SPRING
- 3 – NO SHEET METAL SCREWS, BOLTS, OR ANY OTHER METAL FASTENERS ARE TO BE INSTALLED INTO SHOCK TOWER IN THIS AREA. ALSO, NO HOLES ARE TO BE DRILLED INTO SHOCK TOWER IN THIS SAME AREA.

CAUTION: Only the recommended jacking or hoisting positions for this vehicle are to be used whenever it is necessary to lift a vehicle. Failure to raise a vehicle from the recommended locations could result in lifting a vehicle by the hydraulic control unit mounting bracket. Lifting a vehicle by the hydraulic control unit mounting bracket will result in damage to the mounting bracket and the hydraulic control unit.

MASTER CYLINDER

CAUTION: Different types of master cylinders are used on this vehicle. Vehicles equipped with traction control use a center port master cylinder. Vehicles not equipped with traction control use a compensating port master cylinder. Be sure to verify if the vehicle is equipped with traction control

and that the correct replacement master cylinder is used. Also, vehicles that are equipped with four wheel disc brakes have a master with a different size piston bore than the other master cylinders. If a new master cylinder is being installed, be sure the correct master cylinder is used for the type of brake system the vehicle is equipped with.

REMOVE

CAUTION: Vacuum in the power brake booster must be pumped down (removed) before removing master cylinder from power brake booster. This is necessary to prevent the power brake booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

(1) With engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

CAUTION: Before removing the master cylinder filler tube from the brake fluid reservoir, the filler tube, brake fluid reservoir and master cylinder must be thoroughly cleaned. This must be done to prevent dirt particles from falling into the brake fluid reservoir and entering the brakes hydraulic system.

(2) Thoroughly clean all surfaces of the filler neck, brake fluid reservoir, and master cylinder. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(3) Remove master cylinder filler tube from brake fluid reservoir by pushing down and rotating (Fig. 48). Then remove the cap from the removed filler tube and install it on the master cylinder reservoir.

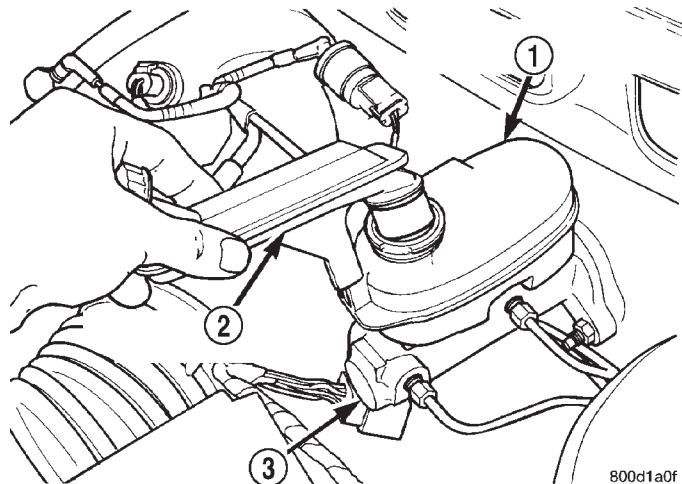


Fig. 48 Master Cylinder Filler Tube Removal

- 1 – MASTER CYLINDER FLUID RESERVOIR
- 2 – MASTER CYLINDER FILLER TUBE
- 3 – MASTER CYLINDER

REMOVAL AND INSTALLATION (Continued)

(4) Remove vehicle wiring harness connector, from the brake fluid level sensor, in master cylinder brake fluid reservoir (Fig. 49).

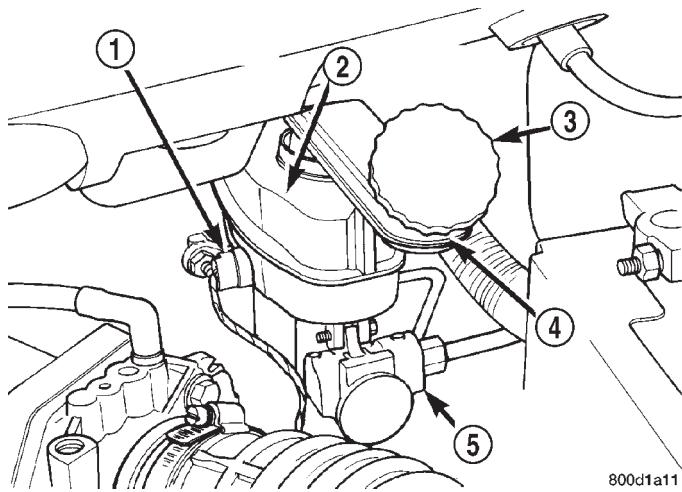


Fig. 49 Electrical Connector At Fluid Level Sensor

- 1 – BRAKE FLUID LOW LEVEL SWITCH
- 2 – BRAKE FLUID RESERVOIR
- 3 – CAP
- 4 – FILLER NECK
- 5 – MASTER CYLINDER ASSEMBLY

(5) Disconnect the primary and secondary brake tubes from the master cylinder housing (Fig. 50). Install sealing plugs in the open brake tube outlets on master cylinder assembly.

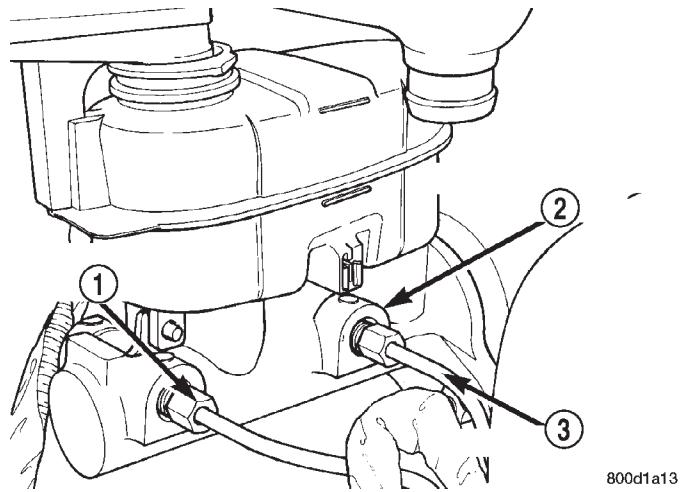


Fig. 50 Primary/Secondary Brake Tubes At Master Cylinder

- 1 – SECONDARY BRAKE TUBE
- 2 – MASTER CYLINDER ASSEMBLY
- 3 – PRIMARY BRAKE TUBE

CAUTION: Before removing the master cylinder from the power brake vacuum booster, the master cylinder and vacuum booster must be thoroughly cleaned. This must be done to prevent dirt particles from falling into the power brake vacuum booster.

(6) Clean the area where the master cylinder assembly attaches to the power brake booster. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(7) Remove the 2 nuts attaching the master cylinder assembly to the brake vacuum booster (Fig. 51).

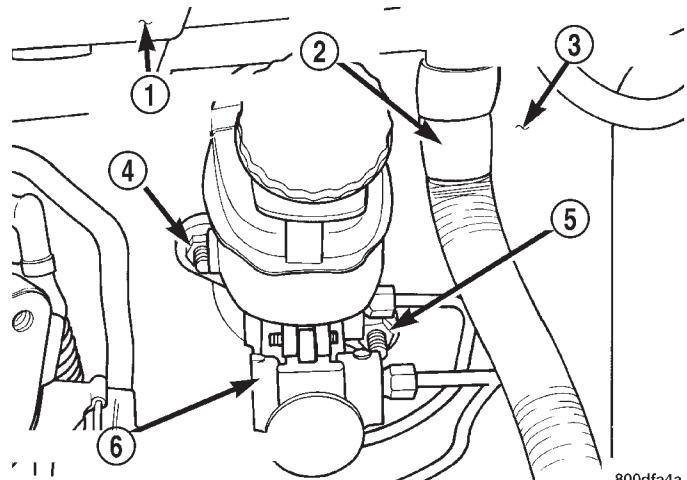


Fig. 51 Master Cylinder Mounting To Vacuum Booster

- 1 – WINDSHIELD WIPER MODULE
- 2 – DRAIN HOSE
- 3 – POWER BRAKE VACUUM BOOSTER
- 4 – NUT
- 5 – NUT
- 6 – MASTER CYLINDER ASSEMBLY

(8) Slide master cylinder assembly straight out of the power brake vacuum booster.

CAUTION: The master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal/boot on the master cylinder **MUST** be replaced whenever the master cylinder is removed from the power brake vacuum booster.

(9) Remove the vacuum seal located on the mounting flange of the master cylinder. The vacuum seal is removed from the master cylinder by **carefully** pulling it away from the master cylinder. **Do not attempt to pry the seal off the master cylinder by inserting a sharp tool between seal and master cylinder casting.**

REMOVAL AND INSTALLATION (Continued)

BLEEDING MASTER CYLINDER

CAUTION: When clamping master cylinder in vise, only clamp master cylinder by its mounting flange, do not clamp on primary piston, seal or body of master cylinder.

- (1) Clamp the master cylinder in a vise using only the mounting flange (Fig. 52).

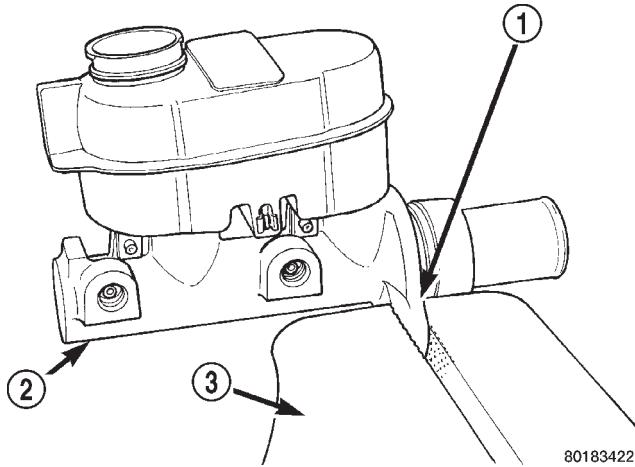


Fig. 52 Master Cylinder Correctly Mounted In Vise

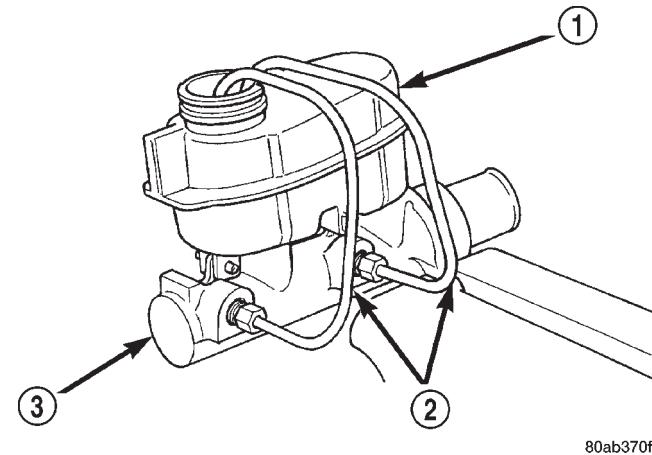
- 1 – MASTER CYLINDER MOUNTING FLANGE
2 – MASTER CYLINDER ASSEMBLY
3 – VISE

NOTE: Two different size bleeding tubes are used depending on which type of master cylinder the vehicle is equipped with. Vehicles equipped with traction control use a center port master cylinder with a larger diameter brake tube. Vehicles not equipped with traction control use a compensating port master cylinder using a standard 3/16 inch diameter brake tube. Be sure the correct size bleeding tubes are used when bleeding the master cylinder.

(2) Install the Bleeding Tubes, Special Tool 6920 for a non traction control master cylinder or Special Tool 8129 for a traction control master cylinder on the master cylinder (Fig. 53). Position bleeding tubes so the outlets of bleeding tubes will be below surface of brake fluid when reservoir is filled to its proper level.

(3) Fill brake fluid reservoir with brake fluid conforming to DOT 3 specifications such as Mopar or an Equivalent.

(4) Using a wooden dowel, (Fig. 53) depress push rod slowly, and then allow pistons to return to released position. Repeat several times until all air bubbles are expelled from master cylinder.



80ab370f

Fig. 53 Bleeding Tubes Installed On Master Cylinder

- 1 – FLUID RESERVOIR
2 – SPECIAL TOOL 6920 OR 8129
3 – MASTER CYLINDER

(5) Remove bleeding tubes from master cylinder outlet ports, and then plug outlet ports and install fill cap on reservoir.

(6) Remove master cylinder from vise.

NOTE: Note: It is not necessary to bleed the ABS hydraulic control unit (HCU) after replacing the master cylinder. But, the base brake hydraulic system must be bled to ensure no air is entered the hydraulic system when the master cylinder was removed.

INSTALL

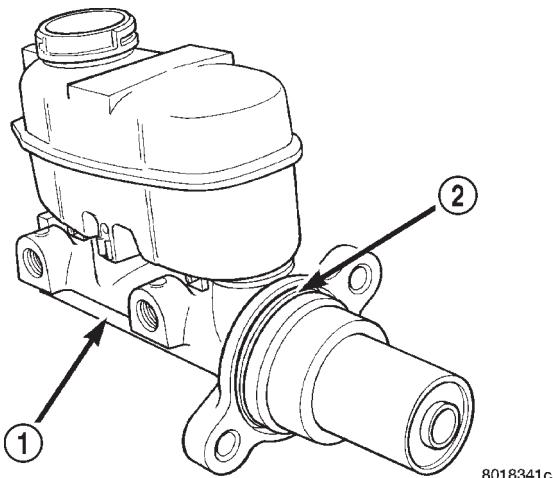
CAUTION: When replacing the master cylinder on a vehicle, a NEW vacuum seal MUST be installed on the master cylinder. Use only procedure detailed below for installing the vacuum seal onto the master cylinder.

(1) Install a NEW vacuum seal on master cylinder making sure seal sits squarely in groove of master cylinder casting (Fig. 54).

(2) Position master cylinder on studs of power brake unit, aligning push rod on power brake vacuum booster with master cylinder push rod.

(3) Install the 2 master cylinder to power brake unit mounting nuts. Then tighten both mounting nuts to a torque of 25 N·m (225 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

**Fig. 54 Vacuum Seal Installed On Master Cylinder**

- 1 – MASTER CYLINDER ASSEMBLY
2 – VACUUM SEAL

CAUTION: When installing the primary and secondary brake tubes on master cylinder, be sure brake tubes do not contact any other components within the vehicle and that there is slack in the flexible sections of the tubes. This is required due to the movement between the ABS hydraulic control module (HCU) and the master cylinder, when the vehicle is in motion.

(4) Connect the primary and secondary brake tubes to master cylinder primary and secondary ports (Fig. 50). Brake tubes must be held securely when tightened to control orientation of flex section. Then fully tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

(5) Install the vehicle wiring harness connector, on the brake fluid level sensor in the master cylinder brake fluid reservoir (Fig. 49).

(6) Install filler tube into the master cylinder fluid reservoir (Fig. 48).

BRAKE FLUID LEVEL SWITCH

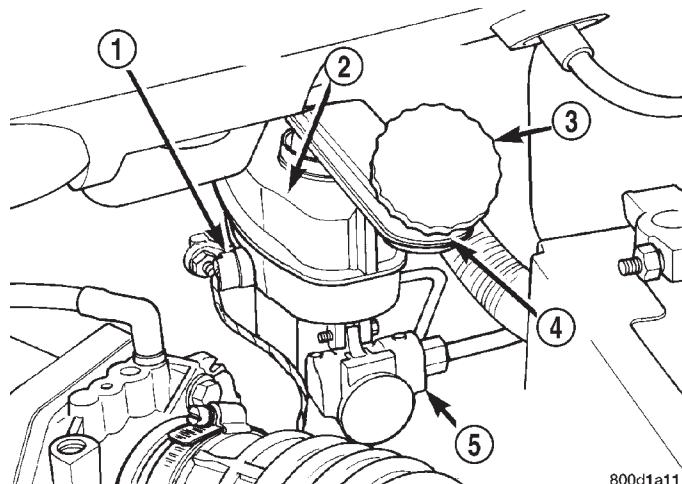
The master cylinder or brake fluid reservoir does not have to be removed from the vehicle for replacement of the brake fluid level switch.

REMOVAL

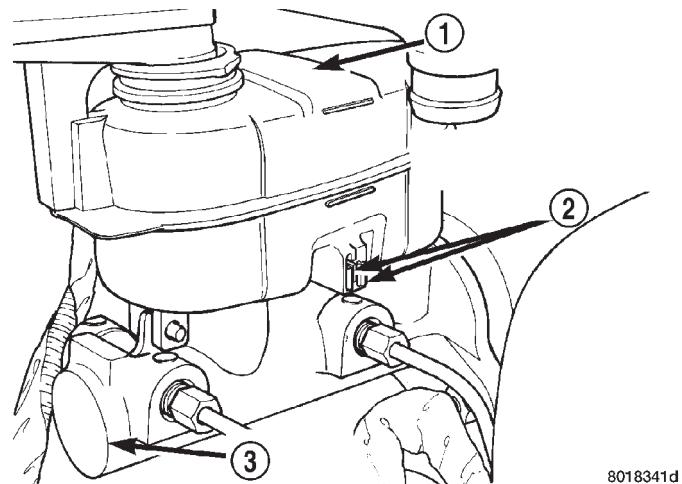
(1) Remove wiring harness connector from brake fluid reservoir level switch (Fig. 55).

(2) Using fingers, compress the retaining tabs on the end of brake fluid level switch (Fig. 56).

(3) With retaining tabs compressed, (Fig. 56) grasp opposite end of brake fluid level switch and pull it out of master cylinder brake fluid reservoir.

**Fig. 55 Fluid Level Sensor Electrical Connection**

- 1 – BRAKE FLUID LOW LEVEL SWITCH
2 – BRAKE FLUID RESERVOIR
3 – CAP
4 – FILLER NECK
5 – MASTER CYLINDER ASSEMBLY

**Fig. 56 Master Cylinder Brake Fluid Level Switch**

- 1 – MASTER CYLINDER FLUID RESERVOIR
2 – BRAKE FLUID LEVEL SENSOR RETAINING TABS
3 – MASTER CYLINDER

INSTALLATION

(1) Insert the brake fluid level switch into brake fluid reservoir. Be sure switch is pushed in until retaining tabs (Fig. 56) lock it to the brake fluid reservoir.

(2) Connect the vehicle wiring harness connector to the brake fluid level switch (Fig. 55).

REMOVAL AND INSTALLATION (Continued)

POWER BRAKE BOOSTER (2.4L ENGINE)

REMOVAL

CAUTION: Reserve vacuum in the booster must be pumped down (removed) before removing master cylinder from vacuum booster. This is necessary to prevent the vacuum booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

- (1) With engine not running, pump brake pedal until a firm pedal is achieved (4-5 strokes).
- (2) Remove both battery cables from battery.
- (3) Remove the battery thermal guard and the battery from the battery tray.
- (4) Remove the air inlet resonator and hoses as an assembly from the throttle body and air cleaner housing (Fig. 57)

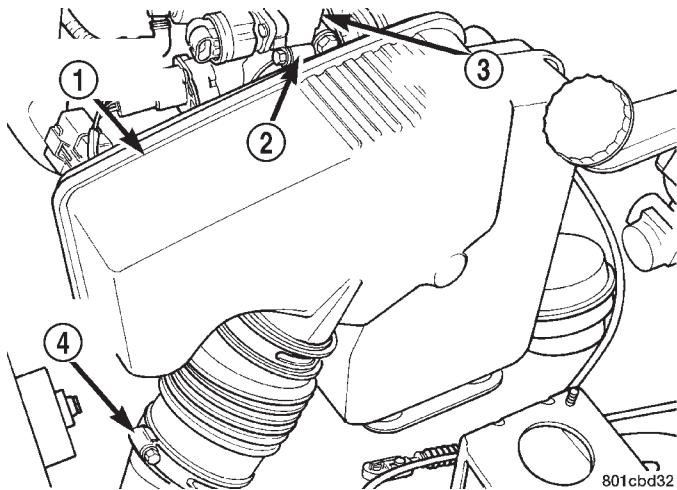


Fig. 57 Air Inlet Resonator

- 1 – AIR INLET RESONATOR
2 – CLAMP
3 – THROTTLE BODY
4 – HOSE CLAMP

(5) If vehicle is equipped with speed control, unplug wiring harness connector from the speed control servo. Then disconnect vacuum lines from the speed control servo and vacuum reservoir on battery tray.

(6) Remove bolt attaching the speed control servo bracket to the battery tray. Slide the bracket forward to unhook it from the battery tray and remove.

(7) Remove the 2 bolts and the nut (Fig. 58) attaching the battery tray to the body.

(8) Remove wiring harness connector from brake fluid level sensor in master cylinder fluid reservoir (Fig. 59).

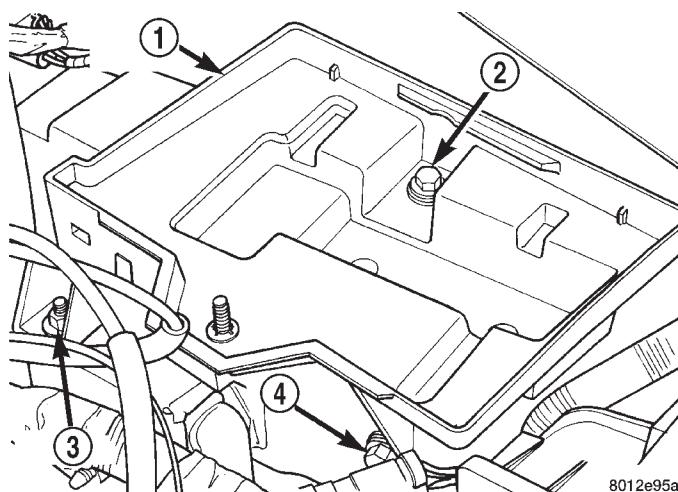


Fig. 58 Battery Tray Mounting Locations

- 1 – BATTERY TRAY
2 – BOLT
3 – NUT
4 – BOLT

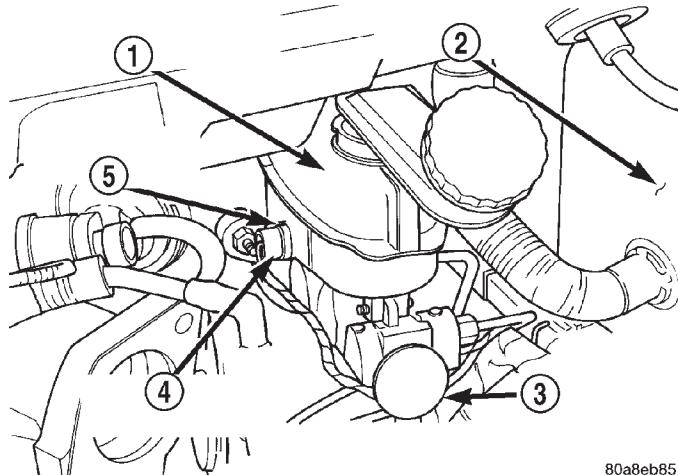


Fig. 59 Fluid Level Sensor Electrical Connection

- 1 – MASTER CYLINDER FLUID RESERVOIR
2 – LEFT STRUT TOWER
3 – MASTER CYLINDER
4 – ELECTRICAL CONNECTOR
5 – FLUID LEVEL SENSOR

(9) Clean the area where the master cylinder assembly attaches to the power brake booster. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(10) Remove clip attaching drain hose for wiper module to brake tube at master cylinder. Remove drain hose (Fig. 60) from wiper module. Remove the 2 nuts attaching the master cylinder to the vacuum booster (Fig. 60).

REMOVAL AND INSTALLATION (Continued)

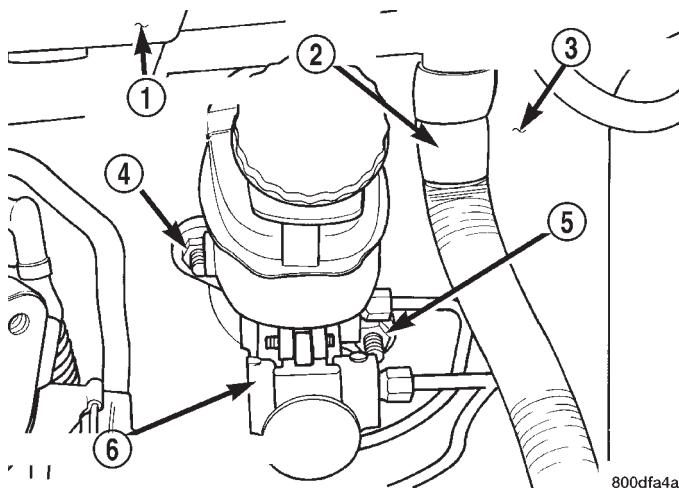


Fig. 60 Master Cylinder Attachment To Vacuum Booster

- 1 - WINDSHIELD WIPER MODULE
- 2 - DRAIN HOSE
- 3 - POWER BRAKE VACUUM BOOSTER
- 4 - NUT
- 5 - NUT
- 6 - MASTER CYLINDER ASSEMBLY

NOTE: It is not necessary to remove the brake tubes from the master cylinder when removing the master cylinder from the vacuum booster.

(11) Remove the master cylinder and brake tubes as an assembly from the vacuum booster. When master cylinder is removed, lay it out of the way on top of the left motor mount

(12) Disconnect vacuum hose from check valve located on vacuum booster. **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(13) Locate the vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the center tang on the vacuum booster input rod to brake pedal pin retaining clip (Fig. 61).

(14) Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. It is not to be reused. Replace only with a new retaining clip when assembled.**

(15) Remove the 4 nuts attaching the vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly.

(16) From outside the vehicle, slide vacuum booster forward until its mounting studs clear dash panel. Then tilt the booster up and toward the center of vehicle to remove.

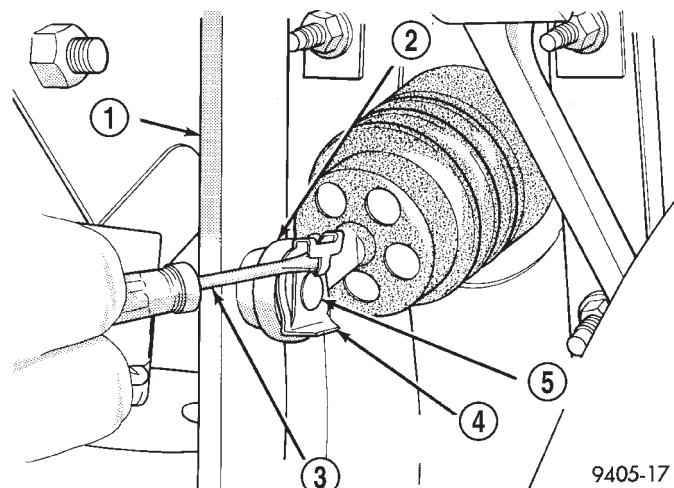


Fig. 61 Input Rod Retaining Pin

- 1 - BRAKE PEDAL
- 2 - INPUT ROD
- 3 - SCREWDRIVER
- 4 - RETAINING CLIP
- 5 - BRAKE PEDAL PIN

CAUTION: Do not attempt to disassemble the vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALLATION

CAUTION: When installing the vacuum booster in the vehicle be sure the heater hoses do not become trapped between the booster and the dash panel of the vehicle.

(1) Position vacuum booster onto dash panel using the reverse procedure for its removal.

(2) Install the 4 mounting nuts for the vacuum booster. Tighten the 4 mounting nuts to a torque of 29 N·m (250 in. lbs.).

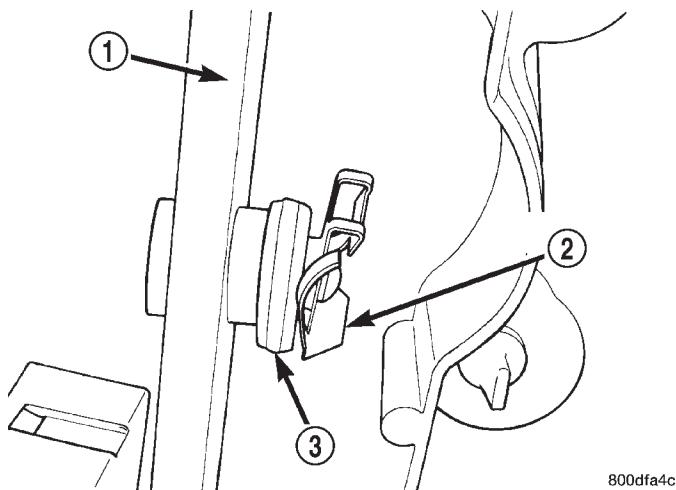
(3) Using lubriplate, or an equivalent, coat the surface of the brake pedal pin where it contacts the vacuum booster input rod.

CAUTION: When installing the brake pedal pin on the vacuum booster input rod, do not re-use the old retaining clip.

(4) Connect the vacuum booster input rod on the brake pedal pin and install a **NEW** retaining clip (Fig. 62).

(5) Connect the vacuum hose on the check valve in the vacuum booster.

REMOVAL AND INSTALLATION (Continued)

**Fig. 62 Retaining Clip Installed On Brake Pedal Pin**

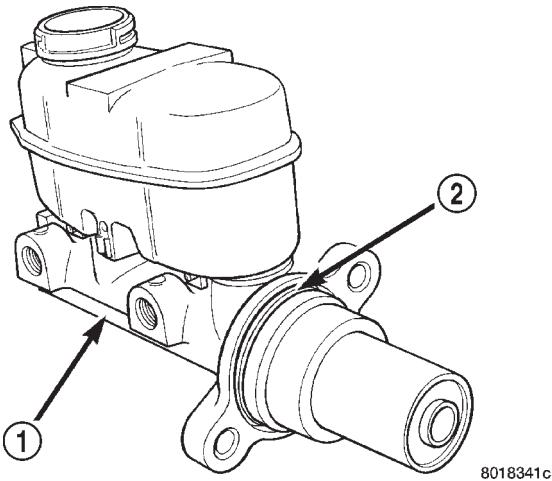
- 1 – BRAKE PEDAL
2 – RETAINING CLIP
3 – BOOSTER INPUT ROD

CAUTION: The master cylinder is used to create the seal for holding vacuum in the vacuum booster. The vacuum seal on the master cylinder **MUST** be replaced with a **NEW** seal whenever the master cylinder is removed from the vacuum booster.

CAUTION: When removing the vacuum seal from the master cylinder do not use a sharp tool.

(6) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

(7) Install a **NEW** vacuum seal on mounting flange of master cylinder (Fig. 63).

**Fig. 63 Vacuum Seal Installed On Master Cylinder**

- 1 – MASTER CYLINDER ASSEMBLY
2 – VACUUM SEAL

(8) Position master cylinder on studs of vacuum booster aligning push rod on vacuum booster with master cylinder piston.

(9) Install the 2 nuts (Fig. 60) mounting the master cylinder to the vacuum booster. Tighten the mounting nuts to a torque of 25 N·m (225 in. lbs.).

(10) Install the wiper module drain hose (Fig. 60) on the wiper module. Install the tie strap attaching the wiper module drain hose to the brake tube at the master cylinder. **Tie strap should be loosely tightened so as not to collapse the wiper module drain hose.**

(11) Install the wiring harness connector on the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 59).

(12) Install the battery tray in the vehicle. Install the 2 bolts and the nut (Fig. 58) attaching the battery tray. Tighten the 2 bolts and the nut to a torque of 14 N·m (125 in lbs.).

(13) If vehicle is equipped with speed control, install the speed control servo and bracket on the battery tray. Install and securely tighten bolt attaching bracket to battery tray.

(14) If vehicle is equipped with speed control, install the wiring harness connector on the speed control servo. Then connect the vacuum lines onto the speed control servo and vacuum reservoir on battery tray.

(15) Install the air inlet resonator and hoses as an assembly on the throttle body and air cleaner housing (Fig. 57). Securely tighten the hose clamp at the air cleaner housing and throttle body.

(16) Install the battery and the battery thermal guard.

(17) Install the battery cables on the battery.

(18) Check the operation of the stop lamp switch and adjust if necessary.

POWER BRAKE BOOSTER (3.0L ENGINE)**REMOVAL**

CAUTION: Stored vacuum in the booster must be pumped down (removed) before removing master cylinder from power brake booster. This is necessary to prevent the power brake booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

(1) With engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

(2) Remove both battery cables from battery.

(3) Remove the battery thermal guard and the battery from the battery tray.

REMOVAL AND INSTALLATION (Continued)

(4) Remove the air inlet resonator and hoses as an assembly from the throttle body and air cleaner housing (Fig. 64)

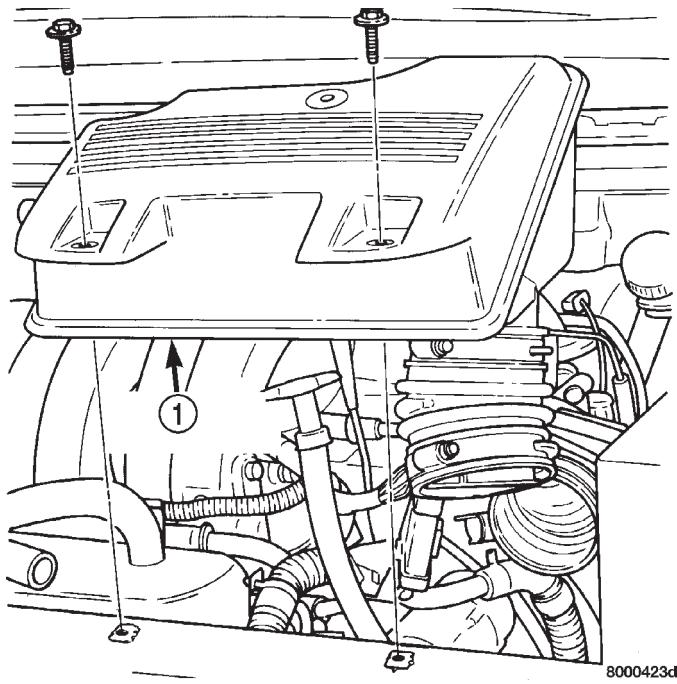


Fig. 64 Air Inlet Resonator

1 – AIR INLET RESONATOR

(5) If vehicle is equipped with speed control, unplug wiring harness connector from the speed control servo. Then disconnect vacuum lines from the speed control servo and vacuum reservoir on battery tray.

(6) Remove bolt attaching the speed control servo bracket to the battery tray. Slide the bracket forward to unhook it from the battery tray and remove.

(7) Remove the 2 bolts and the nut (Fig. 65) attaching the battery tray to the body of the vehicle.

(8) Remove wiring harness connector from brake fluid level sensor in master cylinder fluid reservoir (Fig. 66).

(9) Clean the area where the master cylinder assembly attaches to the power brake booster. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(10) Remove clip attaching drain hose to brake tube at master cylinder. Remove drain hose (Fig. 67) from wiper module. Remove the 2 nuts attaching the master cylinder assembly to the power brake vacuum booster (Fig. 67).

NOTE: It is not necessary to remove the brake tubes from the master cylinder when removing the master cylinder from the power brake vacuum booster.

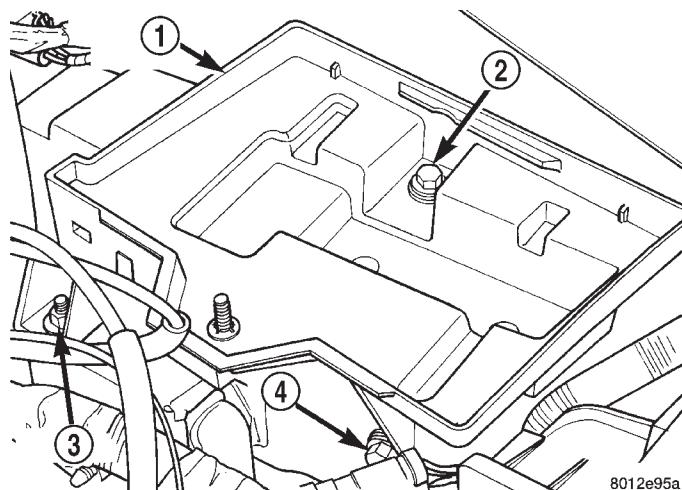


Fig. 65 Battery Tray Mounting Locations

1 – BATTERY TRAY

2 – BOLT

3 – NUT

4 – BOLT

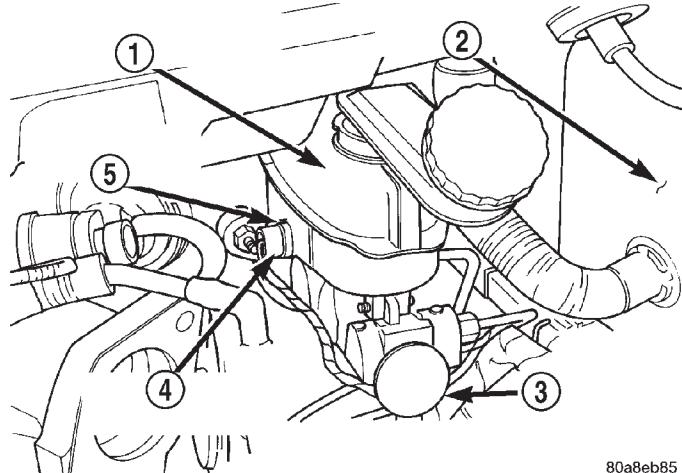


Fig. 66 Electrical Connection To Fluid Level Sensor

1 – MASTER CYLINDER FLUID RESERVOIR

2 – LEFT STRUT TOWER

3 – MASTER CYLINDER

4 – ELECTRICAL CONNECTOR

5 – FLUID LEVEL SENSOR

(11) Remove the master cylinder and the brake tubes as an assembly from power brake vacuum booster. When master cylinder is removed, lay it out of the way on top of the left motor mount

(12) Disconnect vacuum hose from check valve located on power brake vacuum booster. **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(13) Locate the power brake vacuum booster input rod to brake pedal attachment under instrument panel. Position a small screwdriver between the cen-

REMOVAL AND INSTALLATION (Continued)

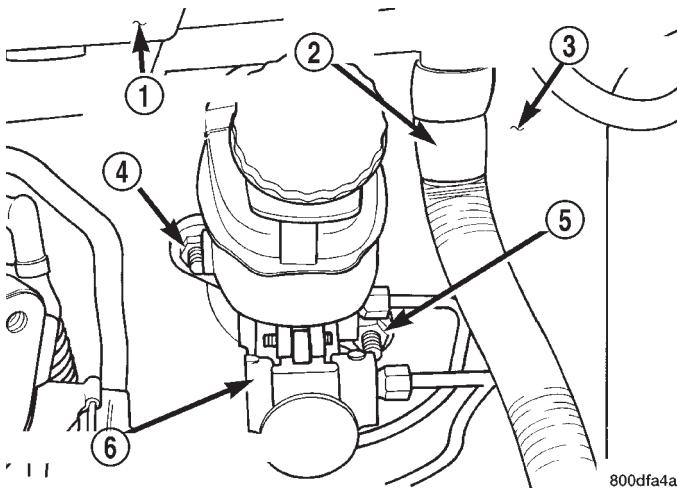


Fig. 67 Master Cylinder Attachment To Power Brake Vacuum Booster

- 1 - WINDSHIELD WIPER MODULE
- 2 - DRAIN HOSE
- 3 - POWER BRAKE VACUUM BOOSTER
- 4 - NUT
- 5 - NUT
- 6 - MASTER CYLINDER ASSEMBLY

ter tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 68).

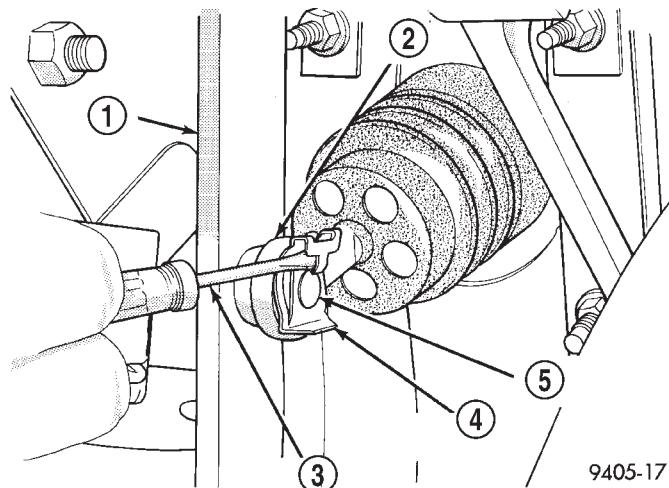


Fig. 68 Booster Input Rod Retaining Pin

- 1 - BRAKE PEDAL
- 2 - INPUT ROD
- 3 - SCREWDRIVER
- 4 - RETAINING CLIP
- 5 - BRAKE PEDAL PIN

(14) Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. It is not to be reused. Replace only with a new retaining clip when assembled.**

(15) Remove the 4 nuts attaching the vacuum booster to the dash panel. Nuts are accessible from under dash panel in area of the steering column and pedal bracket assembly.

(16) From outside the vehicle, slide power brake vacuum booster forward until its mounting studs clear dash panel. Then tilt the booster up and toward the center of vehicle to remove.

CAUTION: Do not attempt to disassemble the power brake vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALLATION

CAUTION: When installing the power brake vacuum booster in the vehicle be sure the heater hoses do not become trapped between the booster and the dash panel of the vehicle.

(1) Position power brake booster onto dash panel using the reverse procedure for its removal.

(2) Install the 4 power brake vacuum booster mounting nuts. Tighten the 4 mounting nuts to a torque of 29 N·m (250 in. lbs.).

(3) Using lubriplate, or an equivalent, coat the surface of the brake pedal pin where it contacts the brake vacuum booster input rod.

CAUTION: When installing the brake pedal pin on the power brake vacuum booster input rod, do not re-use the old retaining clip.

(4) Connect power brake vacuum booster input rod on the brake pedal pin and install a **NEW** retaining clip (Fig. 69).

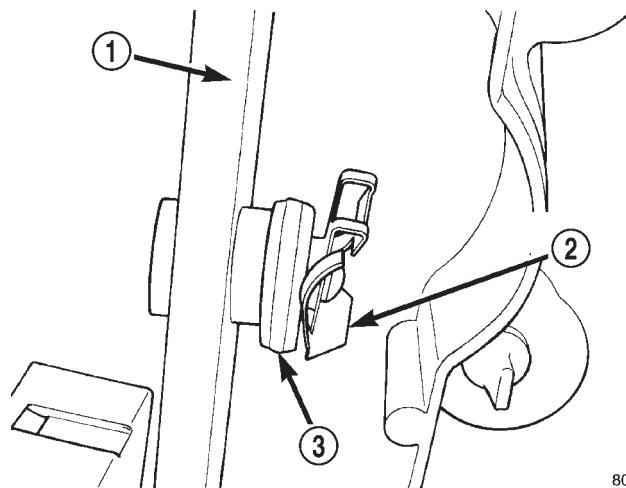


Fig. 69 Retaining Pin Installed On Brake Pedal Pin

- 1 - BRAKE PEDAL
- 2 - RETAINING CLIP
- 3 - BOOSTER INPUT ROD

REMOVAL AND INSTALLATION (Continued)

(5) Connect the vacuum hose on the check valve in the power brake vacuum booster.

CAUTION: The master cylinder is used to create the seal for holding vacuum in the power brake vacuum booster. The vacuum seal on the master cylinder MUST be replaced with a NEW seal whenever the master cylinder is removed from the power brake vacuum booster.

CAUTION: When removing the vacuum seal from the master cylinder do not use a sharp tool.

(6) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

(7) Install a NEW vacuum seal on mounting flange of master cylinder assembly (Fig. 70).

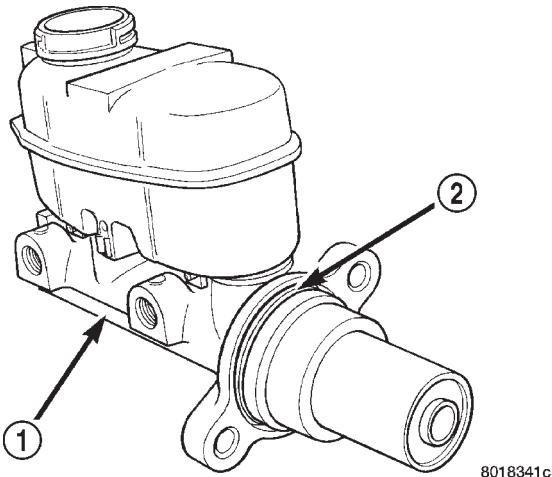


Fig. 70 Vacuum Seal Installed On Master Cylinder

1 – MASTER CYLINDER ASSEMBLY

2 – VACUUM SEAL

(8) Position master cylinder on studs of power brake booster, aligning push rod on power brake vacuum booster with master cylinder push rod.

(9) Install the 2 master cylinder to power brake unit mounting nuts (Fig. 67). Tighten both mounting nuts to a torque of 25 N·m (225 in. lbs.).

(10) Install the wiper module drain hose (Fig. 67) on the wiper module. Install the tie strap attaching the wiper module drain hose to brake tube at the master cylinder. **Tie strap should be loosely tightened so as not to collapse the wiper module drain hose.**

(11) Install the wiring harness connector on the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 66).

(12) Install the battery tray in the vehicle. Install the 2 bolts and the nut (Fig. 65) attaching the bat-

tery tray to the vehicle. Tighten the 2 bolts and the nut to a torque of 14 N·m (125 in lbs.).

(13) If vehicle is equipped with speed control, install the speed control servo and bracket on the battery tray. Install and securely tighten bolt attaching bracket to battery tray.

(14) If vehicle is equipped with speed control, install the wiring harness connector on the speed control servo. Then connect the vacuum lines onto the speed control servo and vacuum reservoir on battery tray.

(15) Install the air inlet resonator and hoses as an assembly on the throttle body and air cleaner housing (Fig. 64). Securely tighten the hose clamp at the air cleaner housing and throttle body.

(16) Install the battery and the battery thermal guard.

(17) Install the battery cables on the battery.

(18) Check the operation of the stop lamp switch and adjust if necessary.

POWER BRAKE BOOSTER (3.3L/3.8L ENGINE)

REMOVAL

CAUTION: Reserve vacuum in the booster must be pumped down (removed) before removing master cylinder from vacuum booster. This is necessary to prevent the vacuum booster from sucking in any contamination as the master cylinder is removed. This can be done simply by pumping the brake pedal, with the vehicle's engine not running, until a firm feeling brake pedal is achieved.

(1) With engine not running, pump the brake pedal until a firm pedal is achieved (4-5 strokes).

(2) Remove both battery cables from battery.

(3) Remove the battery thermal guard and the battery from the battery tray.

(4) Remove the air inlet resonator and hoses as an assembly from the throttle body and air cleaner housing.

(5) If vehicle is equipped with speed control, unplug wiring harness connector from the speed control servo. Then disconnect vacuum lines from the speed control servo and vacuum reservoir on battery tray.

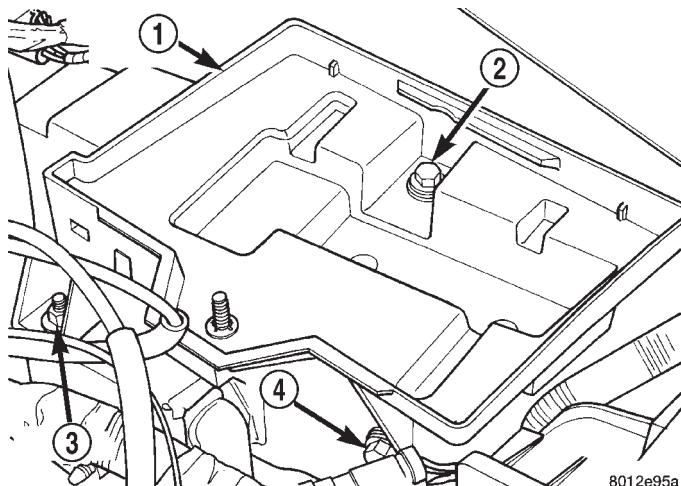
(6) Remove bolt attaching the speed control servo bracket to the battery tray. Slide the bracket forward to unhook it from the battery tray and remove.

(7) Remove the 2 bolts and the nut (Fig. 71) attaching the battery tray to the body of the vehicle.

(8) Remove the wiring harness connector (Fig. 72) from the EGR valve transducer.

(9) Remove wiring harness connectors from throttle position sensor and AIS motor on throttle body (Fig. 73).

REMOVAL AND INSTALLATION (Continued)

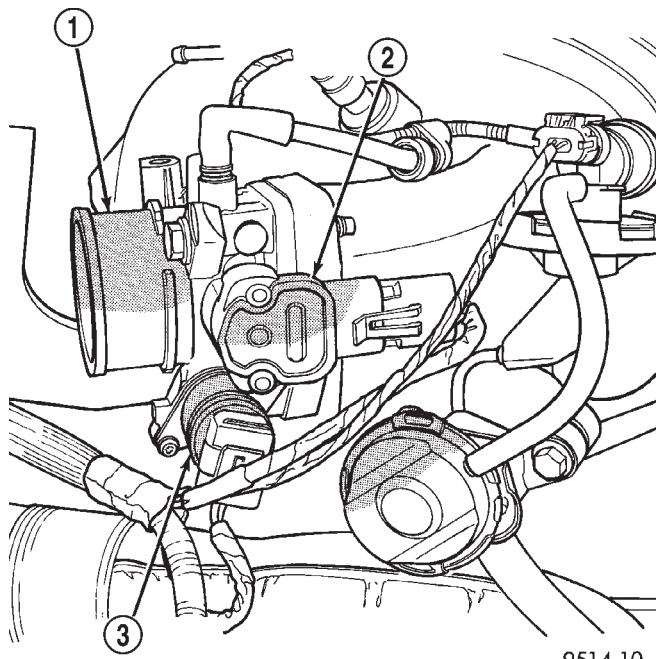
**Fig. 71 Battery Tray Mounting Locations**

1 – BATTERY TRAY

2 – BOLT

3 – NUT

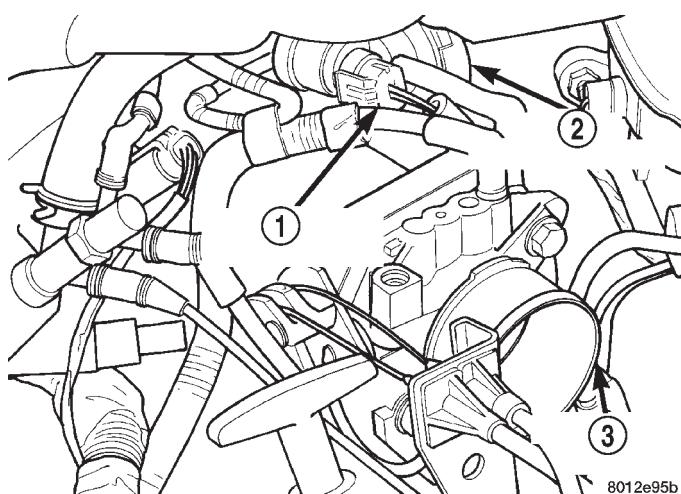
4 – BOLT

**Fig. 73 Electrical And Vacuum Connections To Throttle Body**

1 – THROTTLE BODY

2 – THROTTLE POSITION SENSOR

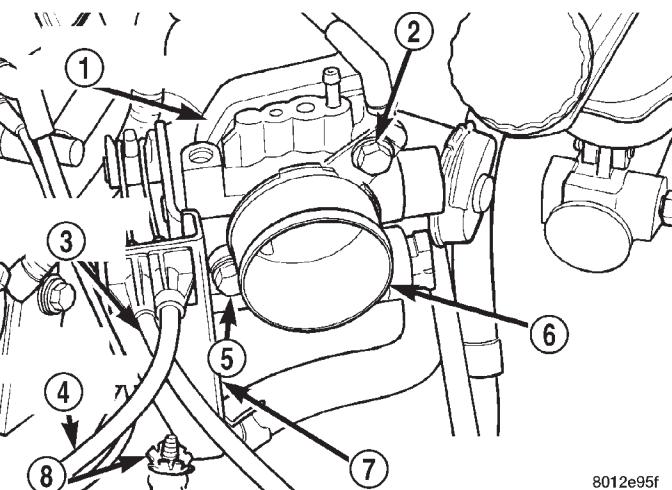
3 – IDLE AIR CONTROL MOTOR

**Fig. 72 Electrical Connector At EGR Transducer**

1 – ELECTRICAL CONNECTOR

2 – EGR TRANSDUCER

3 – THROTTLE BODY

**Fig. 74 Throttle Body Attachment To Intake Manifold**

1 – INTAKE MANIFOLD

2 – BOLT

3 – THROTTLE CABLE

4 – SPEED CONTROL CABLE

5 – BOLT

6 – THROTTLE BODY

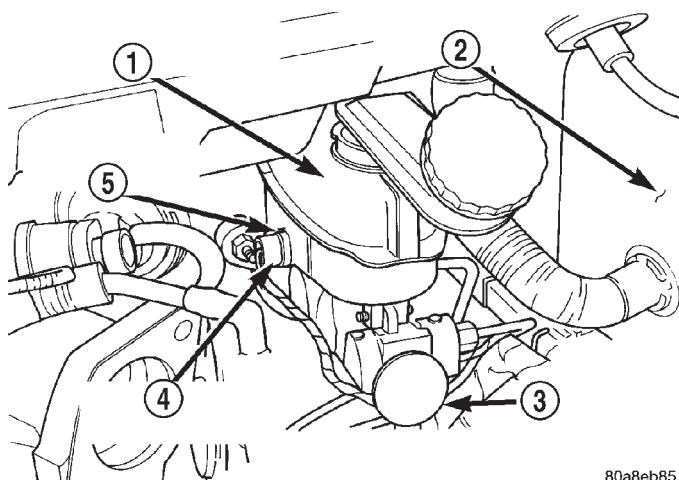
7 – THROTTLE CABLE BRACKET

8 – CLIP

(10) Remove the 2 bolts (Fig. 74) attaching the throttle body to the intake manifold and the clip (Fig. 74) attaching the wiring harness to the throttle cable bracket. Then remove the throttle body and throttle cable bracket as an assembly from the intake manifold.

(11) Remove wiring harness connector from brake fluid level sensor in master cylinder fluid reservoir (Fig. 75).

REMOVAL AND INSTALLATION (Continued)



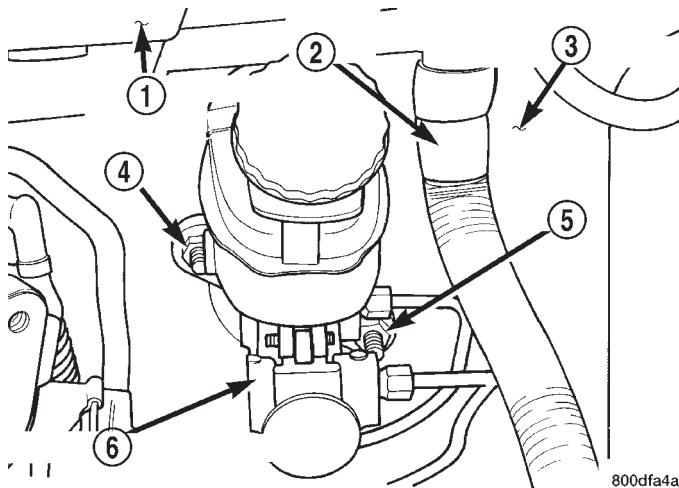
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Fig. 75 Fluid Level Sensor Electrical Connection

- 1 - MASTER CYLINDER FLUID RESERVOIR
- 2 - LEFT STRUT TOWER
- 3 - MASTER CYLINDER
- 4 - ELECTRICAL CONNECTOR
- 5 - FLUID LEVEL SENSOR

(12) Clean the area where the master cylinder assembly attaches to the power brake booster. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(13) Remove clip, attaching drain hose for wiper module to brake tube at master cylinder. Remove drain hose (Fig. 76) from wiper module. Remove the 2 nuts, attaching the master cylinder to the vacuum booster (Fig. 76).



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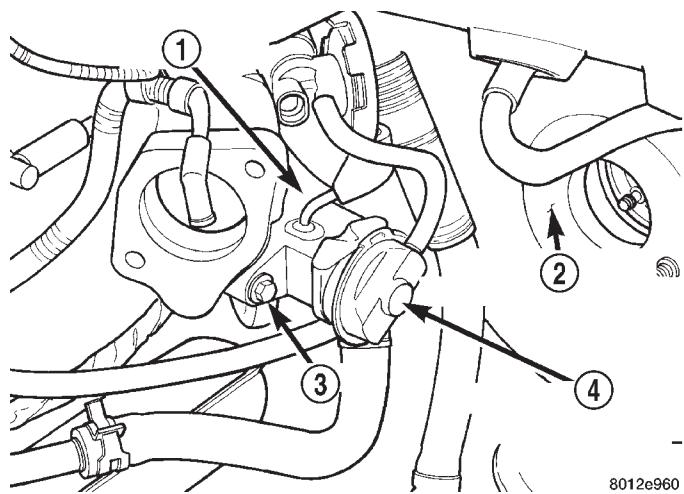
Fig. 76 Master Cylinder Attachment To Vacuum Booster

- 1 - WINDSHIELD WIPER MODULE
- 2 - DRAIN HOSE
- 3 - POWER BRAKE VACUUM BOOSTER
- 4 - NUT
- 5 - NUT
- 6 - MASTER CYLINDER ASSEMBLY

NOTE: It is not necessary to remove the brake tubes from the master cylinder when removing the master cylinder from the vacuum booster.

(14) Remove master cylinder and brake tubes as an assembly from the vacuum booster. When master cylinder is removed, lay it out of the way on top of the left motor mount

(15) Remove the EGR Valve and the vacuum transducer (Fig. 77) as an assembly from the intake manifold.



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Fig. 77 EGR Valve Attachment To Intake Manifold

- 1 - INTAKE MANIFOLD
- 2 - POWER BRAKE VACUUM BOOSTER
- 3 - BOLT (2)
- 4 - EGR VALVE AND TRANSDUCER ASSEMBLY

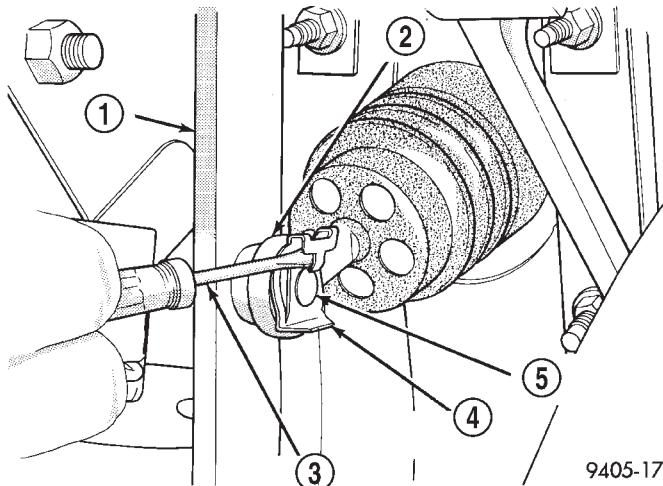
(16) Disconnect vacuum hose from check valve located on vacuum booster. **DO NOT REMOVE CHECK VALVE FROM POWER BRAKE BOOSTER.**

(17) Locate the vacuum booster input rod to brake pedal connection under the instrument panel. Position a small screwdriver between the center tang on the power brake booster input rod to brake pedal pin retaining clip (Fig. 78).

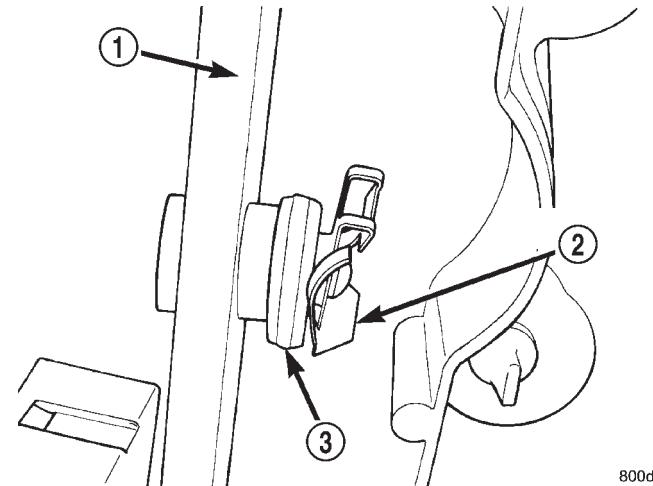
(18) Rotate screwdriver enough to allow retaining clip center tang to pass over end of brake pedal pin. Then pull retaining clip off brake pedal pin. **Discard retaining clip. It is not to be reused. Replace only with a new retaining clip when assembling.**

(19) Remove the 4 nuts attaching the power brake vacuum booster to the dash panel. Nuts are accessi-

REMOVAL AND INSTALLATION (Continued)

**Fig. 78 Vacuum Booster Input Rod Retaining Pin**

- 1 – BRAKE PEDAL
- 2 – INPUT ROD
- 3 – SCREWDRIVER
- 4 – RETAINING CLIP
- 5 – BRAKE PEDAL PIN

**Fig. 79 Retaining Pin Installed On Brake Pedal Pin**

- 1 – BRAKE PEDAL
- 2 – RETAINING CLIP
- 3 – BOOSTER INPUT ROD

ble from under dash panel in area of the steering column and pedal bracket assembly.

(20) From outside the vehicle, slide power brake vacuum booster forward until its mounting studs clear dash panel. Then tilt the booster up and toward the center of vehicle to remove.

CAUTION: Do not attempt to disassemble the power brake vacuum booster it is to be serviced ONLY as a complete assembly.

INSTALLATION

CAUTION: When installing the power brake vacuum booster in the vehicle be sure the heater hoses do not become trapped between the booster and the dash panel of the vehicle.

(1) Position vacuum booster on dash panel using the reverse procedure of its removal.

(2) Install the 4 nuts mounting the vacuum booster to the dash panel. Tighten the 4 mounting nuts to a torque of 29 N·m (250 in. lbs.).

(3) Using lubriplate, or an equivalent, coat the surface of the brake pedal pin where it contacts the vacuum booster input rod.

CAUTION: When installing the brake pedal pin on the power brake vacuum booster input rod, do not re-use the old retaining clip.

(4) Install vacuum booster input rod on brake pedal pin and install a **NEW** retaining clip (Fig. 79).

(5) Connect the vacuum hose on the check valve in the power brake vacuum booster.

(6) Install EGR Valve and vacuum transducer (Fig. 77) on the intake manifold. Install and tighten the 2 EGR valve mounting bolts to a torque of 22 N·m (200 in. lbs.).

CAUTION: The master cylinder is used to create the seal for holding vacuum in the vacuum booster. The vacuum seal on the master cylinder **MUST** be replaced with a **NEW** seal whenever the master cylinder is removed from the vacuum booster.

CAUTION: When removing the vacuum seal from the master cylinder do not use a sharp tool.

(7) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

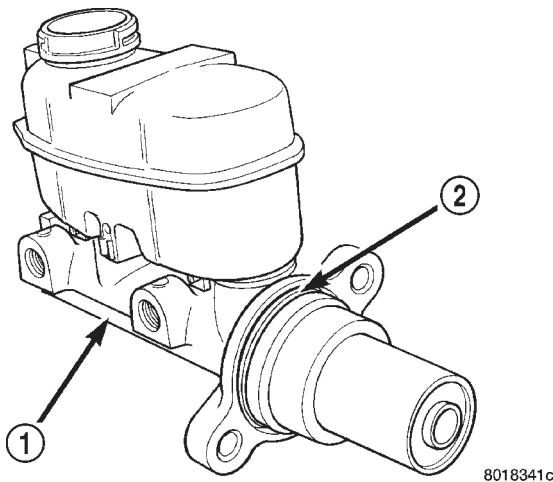
(8) Install a **NEW** vacuum seal on mounting flange of the master cylinder (Fig. 80).

(9) Position master cylinder on studs of vacuum booster, aligning push rod on vacuum booster with master cylinder piston.

(10) Install the 2 nuts mounting the master cylinder to the vacuum booster (Fig. 76). Tighten both mounting nuts to a torque of 25 N·m (225 in. lbs.).

(11) Install the wiper module drain hose (Fig. 76) on the wiper module. Install the tie strap attaching the wiper module drain hose to brake tube at the master cylinder. **Tie strap should be loosely tightened so as not to collapse the wiper module drain hose.**

REMOVAL AND INSTALLATION (Continued)

**Fig. 80 Vacuum Seal Installed On Master Cylinder**

1 – MASTER CYLINDER ASSEMBLY
2 – VACUUM SEAL

(12) Install the wiring harness connector on the brake fluid level sensor in the master cylinder fluid reservoir (Fig. 75).

(13) Install the throttle body and throttle cable bracket on the intake manifold. Install the 2 bolts (Fig. 74) attaching the throttle body to the intake manifold and tighten to a torque of 25 N·m (225 in. lbs.) Install clip (Fig. 74) attaching the wiring harness to the throttle cable bracket..

(14) Install the wiring harness connectors on the throttle position sensor and the AIS motor on throttle body (Fig. 73).

(15) Install the wiring harness connector (Fig. 72) on the EGR valve transducer.

(16) Install the battery tray. Install the 2 bolts and the nut (Fig. 71) attaching the battery tray to the vehicle. Tighten the 2 bolts and the nut to a torque of 14 N·m (125 in lbs.).

(17) If vehicle is equipped with speed control, install the speed control servo and bracket on the battery tray. Install and securely tighten bolt attaching bracket to battery tray.

(18) If vehicle is equipped with speed control, install the wiring harness connector on the speed control servo. Then connect the vacuum lines onto the speed control servo and vacuum reservoir on battery tray.

(19) Install the air inlet resonator and hoses as an assembly on the throttle body and air cleaner housing. Securely tighten hose clamp at air cleaner housing and throttle body.

(20) Install the battery and the battery thermal guard.

(21) Install the battery cables on the battery.

(22) Check the operation of the stop lamp switch and adjust if necessary.

BRAKE TUBES AND HOSES

CAUTION: When installing brake chassis lines or flex hoses on the vehicle, the correct fasteners must be used to attach the routing clips or hoses to the front suspension cradle. The fasteners used to attach components to the front suspension cradle have an anti-corrosion coating due to the suspension cradle being made of aluminum. Only Mopar replacement fasteners with the required anti-corrosion coating are to be used if a replacement fastener is required when installing a brake chassis line or flex hose.

Only double wall 4.75mm (3/16 in.) steel tubing with Al-rich/ZW-AC alloy coating and the correct tube nuts are to be used for replacement of a hydraulic brake tube.

NOTE: On vehicles equipped with traction control, the primary and secondary hydraulic tubes between the master cylinder and the hydraulic control unit are 6 mm (15/64 in.). These tubes are also coated with the Al-rich/ZW-AC alloy and must be replaced with tubes having the same anti-corrosion coating. Be sure that the correct tube nuts are used for the replacement of these hydraulic brake tubes.

Care should be taken when replacing brake tubing, to be sure the proper bending and flaring tools and procedures are used, to avoid kinking. Do not route the tubes against sharp edges, moving components or into hot areas. All tubes should be properly attached with recommended retaining clips.

If the primary or secondary brake tube from the master cylinder to the ABS Hydraulic Control Unit (HCU) or the brake tubes from the HCU to the proportioning valve require replacement, **only** the original factory brake line containing the flexible section can be used as the replacement part. This is required due to cradle movement while the vehicle is in motion.

JUNCTION BLOCK**REMOVAL**

(1) Using a brake pedal depressor, move and lock the brake pedal to a position past its first 1 inch of travel. This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the junction block.

(2) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication And Maintenance Group of this service manual.

REMOVAL AND INSTALLATION (Continued)

CAUTION: Before removing the brake tubes from the junction block, the junction block and the brake tubes must be thoroughly cleaned. This is required to prevent contamination from entering the brake hydraulic system.

- (3) Remove the 6 chassis brake tubes (Fig. 81) from the junction block.

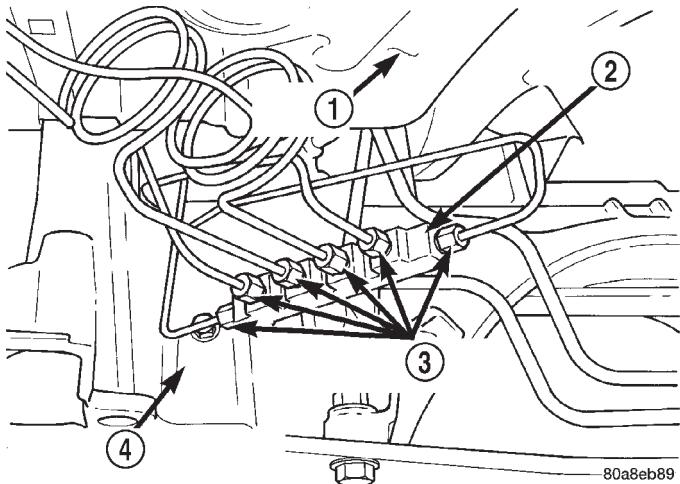


Fig. 81 Junction Block Brake Tubes

- 1 – FLOOR PAN
2 – JUNCTION BLOCK
3 – CHASSIS BRAKE TUBES
4 – FRONT SUSPENSION CRADLE

- (4) Remove the bolts attaching the junction block mounting bracket to the front suspension cradle, then remove the junction block.

INSTALLATION

(1) Install the junction block and mounting bracket on the front suspension cradle. Install the attaching bolts and tighten to a torque of 28 N·m (250 in. lbs.).

(2) Install the 6 chassis brake tubes (Fig. 82) into the inlet and outlet ports of the junction block. Tighten all 6 tube nuts to a torque of 16 N·m (145 in. lbs.).

(3) Bleed the brake system thoroughly to ensure that all air has been expelled from the hydraulic system. See Bleeding Brake System in the Service Adjustments section in this group of the service manual for the proper bleeding procedure.

(4) Lower the vehicle.

(5) Road test the vehicle to verify proper operation of the vehicles brake system.

PROPORTIONING VALVE (HEIGHT SENSING)

The components of the proportioning valve assembly are not serviceable or replaceable. If a component of the proportioning valve assembly is not functioning properly, the proportioning valve must be replaced as an assembly.

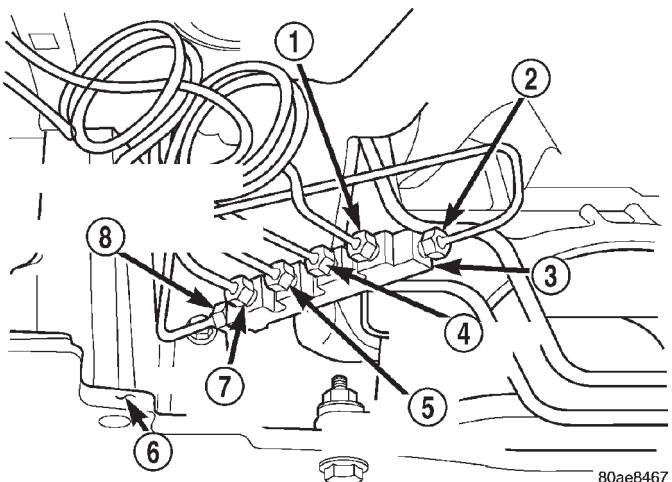


Fig. 82 Brake Tube Connections To Junction Block

- 1 – RIGHT FRONT WHEEL
2 – CHASSIS BRAKE TUBE FROM MASTER CYLINDER
3 – JUNCTION BLOCK
4 – LEFT REAR WHEEL
5 – RIGHT REAR WHEEL
6 – FRONT SUSPENSION CRADLE
7 – LEFT FRONT WHEEL
8 – CHASSIS BRAKE TUBE FROM MASTER CYLINDER

REMOVAL

(1) Using a brake pedal depressor, move and lock the brake pedal to a position past its first 1 inch of travel. This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the proportioning valve.

(2) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication And Maintenance Group of this service manual.

CAUTION: Before removing the brake tubes from the proportioning valve, the proportioning valve and the brake tubes must be thoroughly cleaned. This is required to prevent contamination from entering the proportioning valve or the brake tubes.

(3) Remove the 4 chassis brake tubes from the inlet and outlet ports of the proportioning valve (Fig. 83).

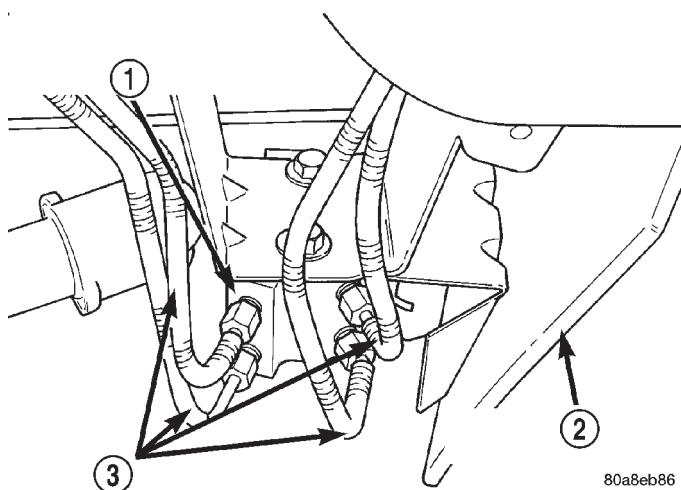
(4) Remove the 2 bolts (Fig. 84) attaching the proportioning valve to the proportioning valve mounting bracket. Remove the proportioning valve from the mounting bracket.

(5) Remove the hooked end of the proportioning valve actuator (Fig. 85) from the isolator bushing on the lever of the height proportioning valve (Fig. 85).

INSTALLATION

(1) Install the hooked end of the actuator on the proportioning valve lever (Fig. 85). **Be sure isolator**

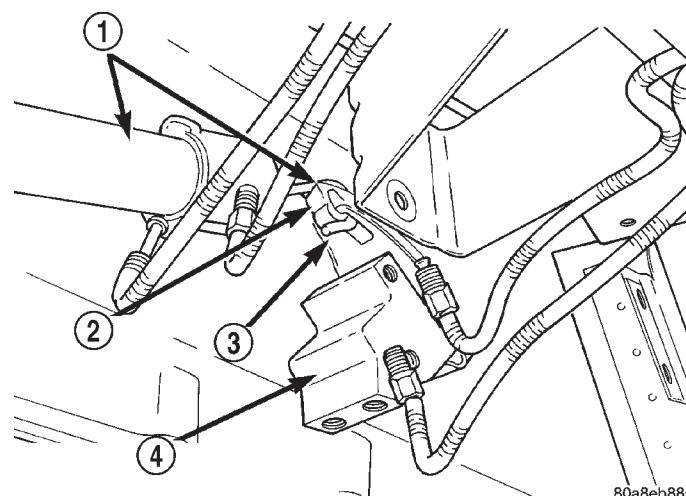
REMOVAL AND INSTALLATION (Continued)



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Fig. 83 Chassis Brake Tubes At Proportioning Valve

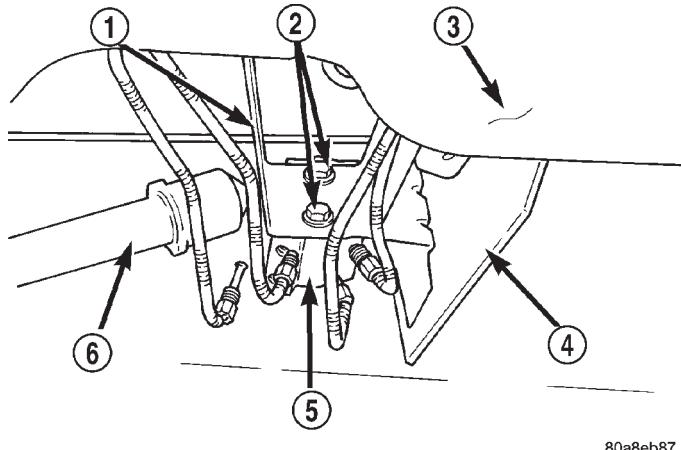
- 1 - HEIGHT SENSING PROPORTIONING VALVE
 2 - PROPORTIONING VALVE SHIELD
 3 - CHASSIS BRAKE LINES



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Fig. 85 Actuator Attachment To Proportioning Valve

- 1 - ACTUATOR
 2 - ISOLATOR BUSHING
 3 - LEVER
 4 - HEIGHT SENSING PROPORTIONING VALVE



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Fig. 84 Proportioning Valve Mounting

- 1 - MOUNTING BRACKET
 2 - MOUNTING BOLTS
 3 - FUEL TANK
 4 - PROPORTIONING VALVE SHIELD
 5 - HEIGHT SENSING PROPORTIONING VALVE
 6 - ACTUATOR ASSEMBLY

bushing on lever of proportioning valve (Fig. 85) is fully seated in hook of actuator.

NOTE: When installing height sensing proportioning valve on mounting bracket be sure proportioning valve shield (Fig. 84) is installed between the proportioning valve and the mounting bracket.

(2) Install height sensing proportioning valve on mounting bracket. Install the proportioning valve attaching bolts (Fig. 84). Tighten the attaching bolts to a torque of 23 N·m (200 in. lbs.).

(3) Install the 4 chassis brake lines (Fig. 83) into the inlet and outlet ports of the proportioning valve. Tighten all 4 line nuts to a torque of 16 N·m (142 in. lbs.).

(4) Adjust the proportioning valve actuator. See Height Sensing Proportioning Valve in the Adjustment Section in this group of the service manual for the adjustment procedure.

(5) Bleed the brake system thoroughly to ensure that all air has been expelled from the hydraulic system. See Bleeding Brake System in the Service Adjustments section in this group of the service manual for the proper bleeding procedure.

(6) Lower the vehicle to the ground.

(7) Road test the vehicle to verify proper operation of the vehicles brake system.

DISC BRAKE CALIPER (FRONT)

NOTE: Before proceeding with this procedure, review the **SERVICE WARNINGS AND CAUTIONS** found at the beginning of the **REMOVAL AND INSTALLATION** section.

REMOVAL

(1) Depress the brake pedal past its first inch of travel and hold it in this position using a brake pedal depressor (holding) tool. This is done to isolate the master cylinder from the brake hydraulic system dis-

REMOVAL AND INSTALLATION (Continued)

allowing the brake fluid to completely drain out of the brake fluid reservoir.

(2) Raise the vehicle. See Hoisting in the Lubrication and Maintenance group of this service manual.

(3) Remove front wheel and tire assembly.

(4) Remove the banjo bolt connecting the brake hose to the brake caliper. There are two washers (one on each side of the brake hose fitting) that will come off with the banjo bolt. Discard these washers.

(5) Remove the 2 caliper to steering knuckle guide pin bolts (Fig. 86).

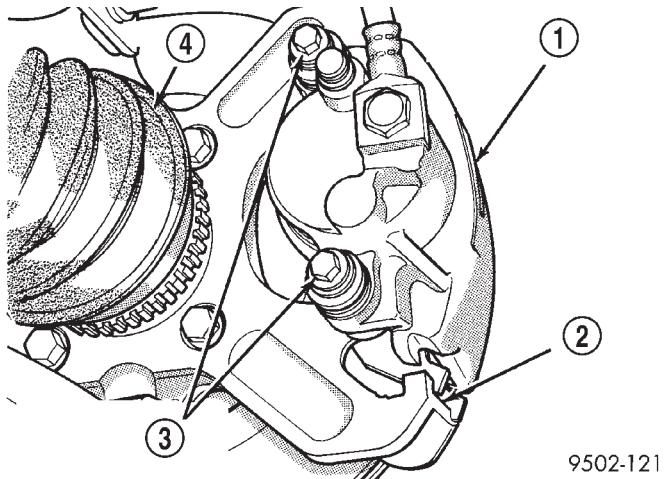


Fig. 86 Guide Pin Bolts

- 1 - DISC BRAKE CALIPER ASSEMBLY
- 2 - STEERING KNUCKLE
- 3 - DISC BRAKE CALIPER MOUNTING BOLTS
- 4 - DRIVESHAFT

(6) Remove the brake caliper from the steering knuckle by first rotating free end of caliper away from steering knuckle, then sliding the opposite end of the caliper out from under machined abutment on steering knuckle (Fig. 87), then remove the brake caliper.

INSTALLATION

(1) Completely retract the caliper piston back into piston bore of the caliper.

(2) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

CAUTION: Use care when installing the brake caliper assembly onto the steering knuckle, so that the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(3) Carefully position the brake caliper and shoes over the brake rotor by hooking lower or upper end of the caliper over the machined abutment on steering knuckle (Fig. 87). Next, rotate the caliper into posi-

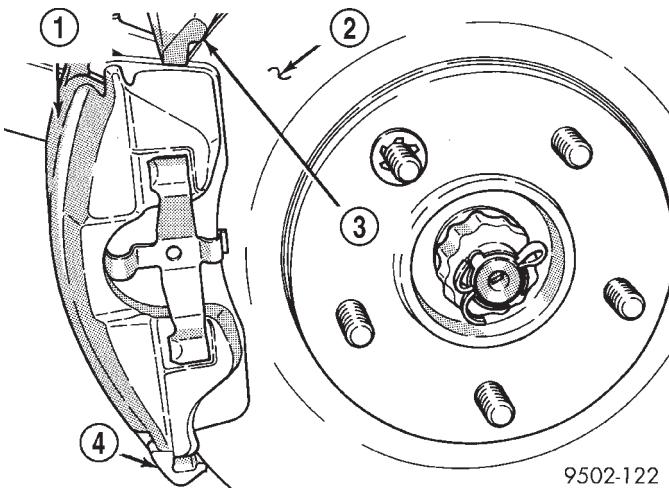


Fig. 87 Caliper Mounting On Steering Knuckle (Typical)

- 1 - CALIPER ASSEMBLY
- 2 - ROTOR
- 3 - STEERING KNUCKLE
- 4 - MACHINED ABUTMENT

tion at the top of the steering knuckle. Make sure that caliper guide pin bolts, bushings and sleeves are clear of the steering knuckle bosses.

(4) Install the caliper guide pin bolts and tighten to a torque of 22 N·m (195 in. lbs.) (Fig. 86). **Extreme caution should be taken not to cross thread the caliper guide pin bolts.**

CAUTION: When connecting the brake hose to the caliper, install new brake hose to caliper special washers.

(5) Install the brake hose on the caliper. To do this, first place one new special fitting washer on each side of the hose fitting, then slide the banjo bolt through the fitting. Next, thread the banjo bolt into the threaded port on the rear of the brake caliper. Tighten the banjo bolt to a torque of 47 N·m (35 ft. lbs.).

(6) Install the wheel and tire assembly.

(7) Using a torque wrench, tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification, then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(8) Lower the vehicle.

(9) Remove the brake pedal depressor (holding) tool.

(10) Bleed the hydraulic brake circuit to the brake caliper. Refer to Base Brake Bleeding in this section.

(11) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

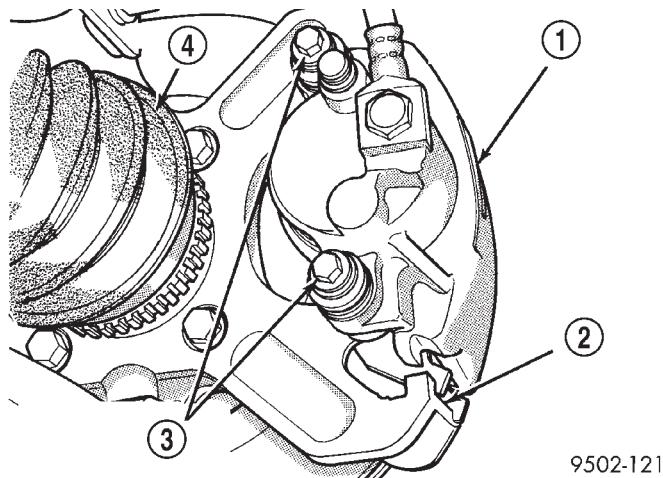
REMOVAL AND INSTALLATION (Continued)

DISC BRAKE SHOES (FRONT)

NOTE: Before proceeding with this procedure, review the SERVICE WARNINGS AND CAUTIONS found at the beginning of the REMOVAL AND INSTALLATION section.

REMOVAL

- (1) Raise the vehicle. See Hoisting in the Lubrication and Maintenance group of this service manual.
- (2) Remove both front wheel and tire assemblies.
- (3) Begin on one side of the vehicle.
- (4) Remove the 2 caliper to steering knuckle guide pin bolts (Fig. 88).

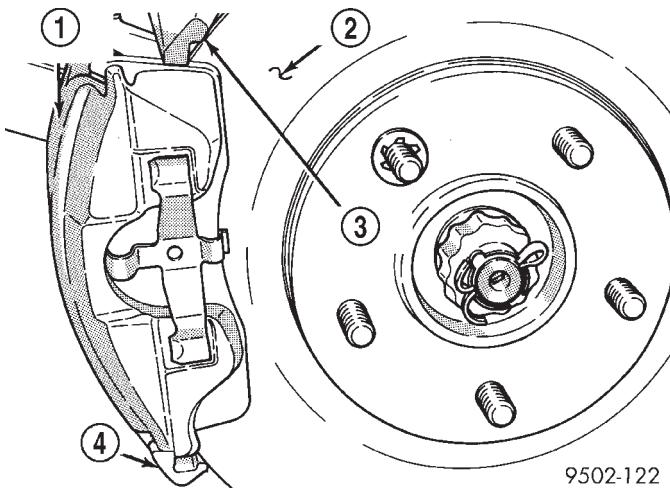
**Fig. 88 Guide Pin Bolts**

- 1 – DISC BRAKE CALIPER ASSEMBLY
 2 – STEERING KNUCKLE
 3 – DISC BRAKE CALIPER MOUNTING BOLTS
 4 – DRIVESHAFT

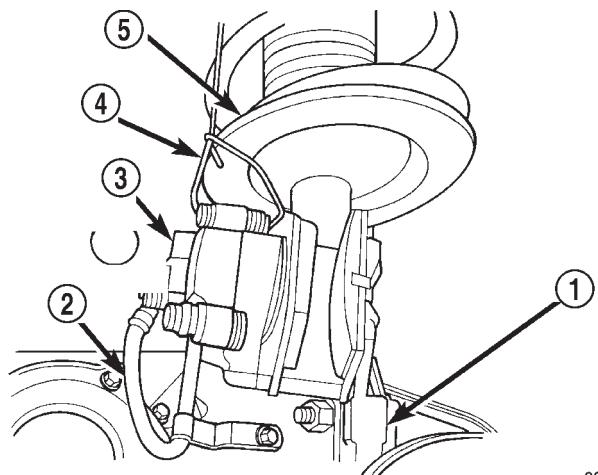
- (5) Remove caliper from steering knuckle by first rotating free end of caliper away from steering knuckle. Next, slide opposite end of caliper out from under machined abutment on steering knuckle (Fig. 89), then remove it from brake rotor.

CAUTION: Supporting weight of caliper by the flexible brake fluid hose can damage the hose.

- (6) Using a wire or cord, hang the caliper from the front strut assembly (Fig. 90). Support the caliper firmly to prevent weight of caliper from being supported by the brake fluid hose.

**Fig. 89 Caliper Mounting On Knuckle (Typical)**

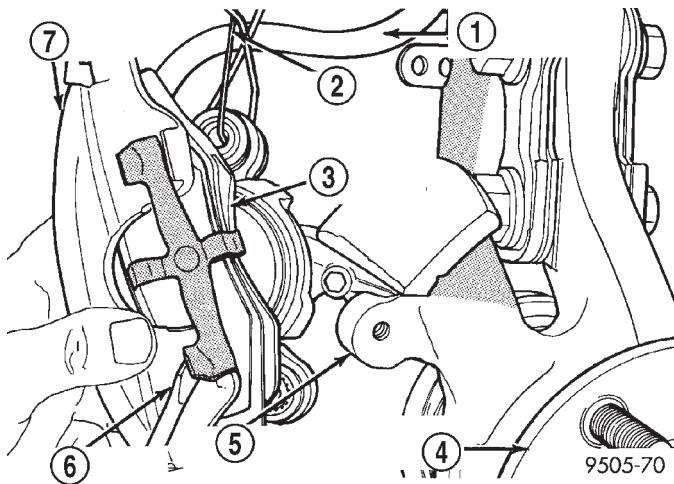
- 1 – CALIPER ASSEMBLY
 2 – ROTOR
 3 – STEERING KNUCKLE
 4 – MACHINED ABUTMENT

**Fig. 90 Stored Front Disc Brake Caliper**

- 1 – STEERING KNUCKLE
 2 – BRAKE FLEX HOSE
 3 – CALIPER ASSEMBLY
 4 – WIRE HANGER
 5 – STRUT ASSEMBLY

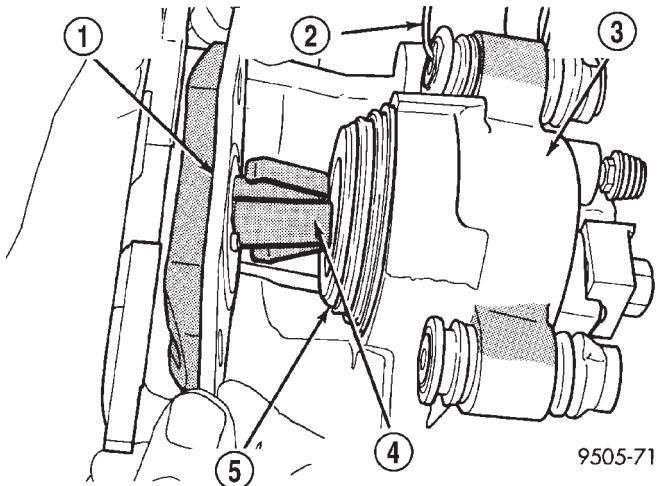
- (7) Remove the outboard brake shoe by prying the shoe's retaining clip over the raised area on the caliper (Fig. 91), then sliding the shoe down and off the caliper.

REMOVAL AND INSTALLATION (Continued)

**Fig. 91 Removing Outboard Shoe**

- 1 - BRAKE FLEX HOSE
- 2 - HANGER WIRE
- 3 - OUTBOARD BRAKE PAD
- 4 - HUB/BEARING ASSEMBLY
- 5 - STEERING KNUCKLE
- 6 - SCREWDRIVER
- 7 - CALIPER ASSEMBLY

(8) Pull the inboard brake shoe away from the caliper piston until the retaining clip on shoe is free from the cavity in the caliper piston (Fig. 92).

**Fig. 92 Removing Inboard Shoe**

- 1 - INBOARD BRAKE SHOE
- 2 - HANGER WIRE
- 3 - CALIPER ASSEMBLY
- 4 - RETAINING CLIP
- 5 - PISTON

(9) Repeat the above procedure on other side of the vehicle.

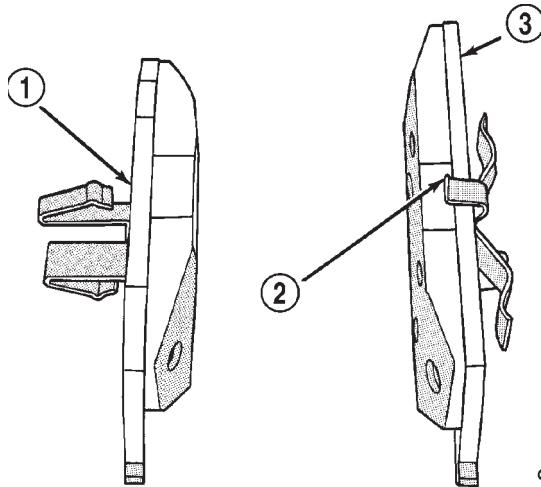
INSTALLATION

(1) Begin on one side of the vehicle.

(2) Completely retract the caliper piston back into its bore in the brake caliper (This is required for caliper installation on the brake rotor with new brake shoes installed).

(3) Remove the protective paper from the noise suppression gasket on the rear of both the inner and outer brake shoe assemblies (if applied).

NOTE: The inboard and outboard brake shoes are not common, refer to (Fig. 93) for inboard and outboard shoe identification.

**Fig. 93 Front Brake Shoe Identification**

- 1 - INBOARD BRAKE SHOE
- 2 - WEAR INDICATOR
- 3 - OUTBOARD BRAKE SHOE

(4) Install the new inboard brake shoe into the caliper piston by firmly pressing its retaining clip into the piston bore (Fig. 94). Be sure the inboard brake shoe is positioned squarely against the face of the caliper piston.

(5) Slide the new outboard brake shoe onto the brake caliper (Fig. 95).

(6) Lubricate both steering knuckle abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

CAUTION: Use care when installing the caliper assembly onto the steering knuckle, so the seals on the caliper guide pin bushings do not get damaged by the steering knuckle bosses.

(7) Carefully position the brake caliper and brake shoes over brake rotor by hooking lower or upper end of caliper over the machined abutment on steering knuckle (Fig. 89). Next, rotate the caliper into position at the top of the steering knuckle (Fig. 89). Make sure that caliper guide pin bolts, bushings and sleeves are clear of the steering knuckle bosses.

REMOVAL AND INSTALLATION (Continued)

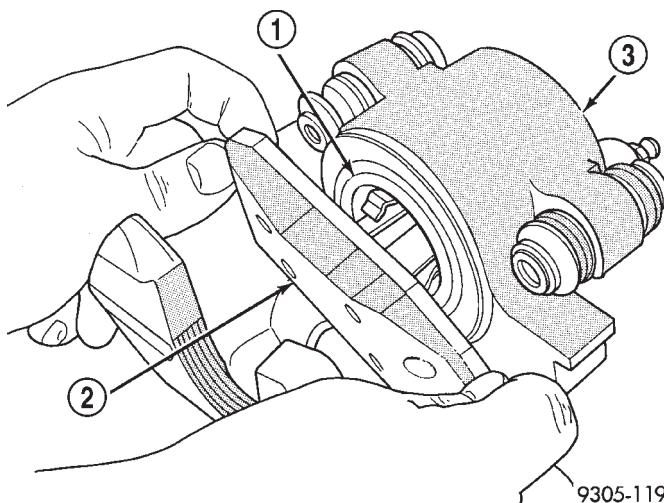


Fig. 94 Installing Inboard Brake Shoe

- 1 – PISTON
2 – BRAKE SHOE
3 – CALIPER ASSEMBLY

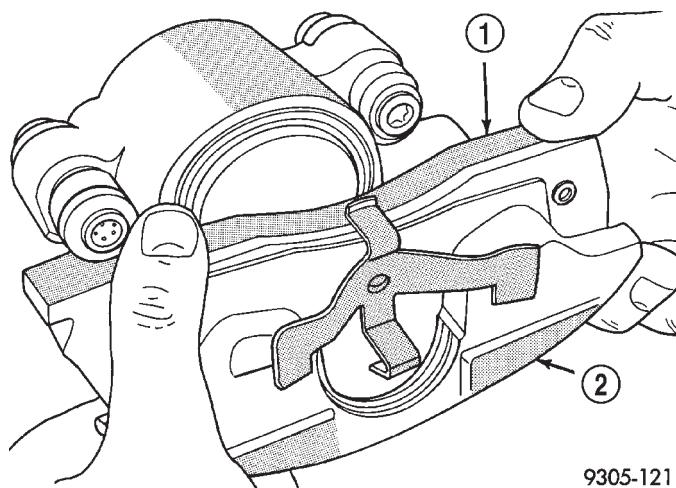


Fig. 95 Installing Outboard Brake Shoe

- 1 – BRAKE SHOE ASSEMBLY
2 – BRAKE CALIPER

(8) Install the caliper guide pin bolts and tighten to a torque of 22 N·m (195 in. lbs.) (Fig. 88). **Extreme caution should be taken not to cross thread the caliper guide pin bolts.**

(9) Install the wheel and tire assembly.
(10) Using a torque wrench, tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification, then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(11) Repeat the above procedure on other side of the vehicle.

(12) Lower vehicle.
(13) Check and adjust brake fluid level as necessary.

(14) Before moving the vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal.

DISC BRAKE CALIPER (REAR)

NOTE: Before proceeding with this procedure, review the **SERVICE WARNINGS AND CAUTIONS** found at the beginning of the **REMOVAL AND INSTALLATION** section.

NOTE: Handling of the rotor and caliper, must be done in such a way as to avoid damage to the rotor and scratching or nicking of lining on the brake shoes.

REMOVAL

(1) Depress the brake pedal past its first inch of travel and hold it in this position using a brake pedal depressor (holding) tool. This is done to isolate the master cylinder from the brake hydraulic system disallowing the brake fluid to completely drain out of the brake fluid reservoir.

(2) Raise the vehicle. Refer to Hoisting in the Lubrication and Maintenance section of this manual.

(3) Remove rear wheel and tire assembly from vehicle.

(4) Remove the banjo bolt connecting the brake hose to the brake caliper. There are two washers (one on each side of the brake hose fitting) that will come off with the banjo bolt. Discard these washers.

(5) Remove the disc brake caliper to adapter guide pin bolts (Fig. 96).

(6) Remove rear caliper from adapter using the following procedure. First rotate rear of caliper up from the adapter. Then pull the front of the caliper and the outboard brake shoe anti-rattle clip out from under the front abutment on the adapter (Fig. 97).

(7) If the brake rotor requires removal, it can now be removed by first removing the retainer clips from the wheel mounting studs, then pulling the rotor straight off the studs.

INSTALLATION

(1) Completely retract caliper piston back into piston bore of the caliper.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) If removed, install the brake rotor on the hub, making sure it is squarely seated on the face of the hub.

REMOVAL AND INSTALLATION (Continued)

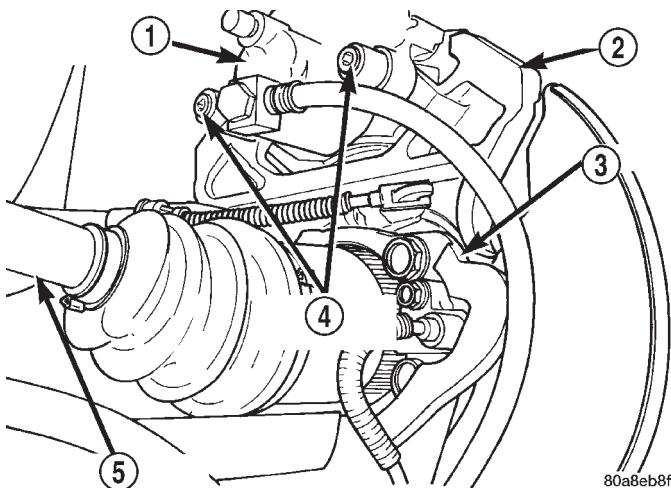


Fig. 96 Caliper Guide Pin Bolts

- 1 - DISC BRAKE CALIPER
 2 - ADAPTER
 3 - AXLE
 4 - GUIDE PIN BOLTS
 5 - DRIVESHAFT

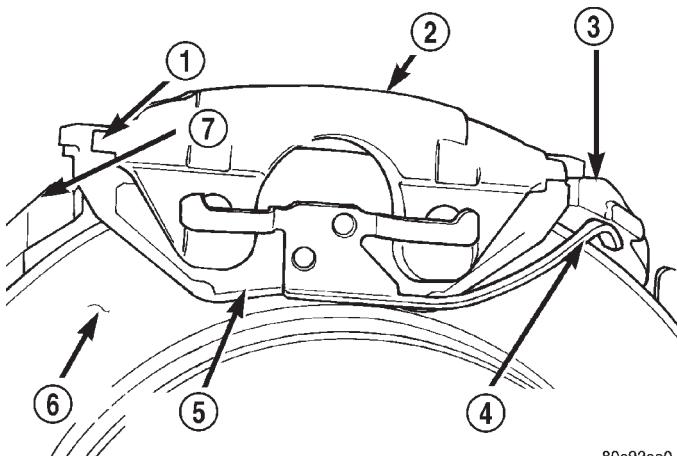


Fig. 97 Removing/Installing Caliper

- 1 - LIFT THIS END OF CALIPER AWAY FROM ADAPTER FIRST
 2 - DISC BRAKE CALIPER
 3 - ADAPTER ABUTMENT
 4 - OUTBOARD BRAKE SHOE HOLD DOWN CLIP
 5 - OUTBOARD BRAKE SHOE
 6 - ROTOR
 7 - ADAPTER

CAUTION: Use care when installing the caliper assembly onto the adapter, so the caliper guide pin bushings do not get damaged by the mounting bosses.

(4) Carefully lower caliper and brake shoes over rotor and onto the adapter using the reverse procedure for removal (Fig. 97).

CAUTION: When installing guide pin bolts extreme caution should be taken not to cross-thread the caliper guide pin bolts.

(5) Install the caliper guide pin bolts. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

CAUTION: When connecting the brake hose to the caliper, install new brake hose to caliper special washers.

(6) Install the brake hose on the caliper. To do this, first place one new special fitting washer on each side of the hose fitting, then slide the banjo bolt through the fitting. Next, thread the banjo bolt into the threaded port on the rear of the brake caliper. Tighten the banjo bolt to a torque of 47 N·m (35 ft. lbs.).

(7) Install the wheel and tire assembly.

(8) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(9) Lower the vehicle.

(10) Remove the brake pedal depressor (holding) tool.

(11) Bleed the hydraulic brake circuit to the brake caliper. Refer to Base Brake Bleeding in this section.

(12) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

DISC BRAKE SHOES (REAR)

NOTE: Before proceeding with this procedure, review the **SERVICE WARNINGS AND CAUTIONS** found at the beginning of the **REMOVAL AND INSTALLATION** section.

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance section of this manual.

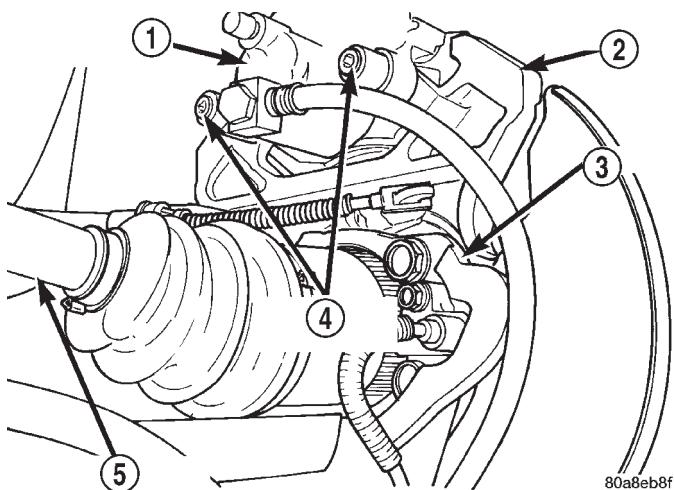
(2) Remove rear wheel and tire assemblies from vehicle.

(3) Remove the caliper to adapter guide pin bolts (Fig. 98).

(4) Remove rear caliper from adapter using the following procedure. First rotate rear of caliper up from the adapter. Then pull the front of the caliper and the outboard brake shoe anti-rattle clip out from under the front abutment on the adapter (Fig. 99).

(5) Support caliper to prevent the weight of the caliper from damaging the flexible brake hose (Fig. 100).

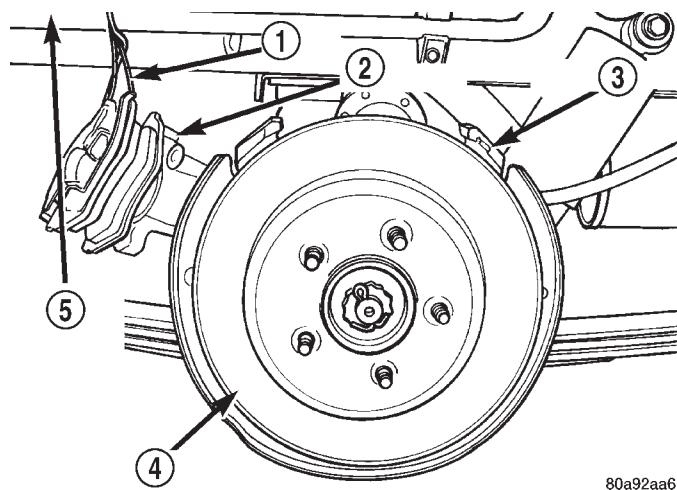
REMOVAL AND INSTALLATION (Continued)



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Fig. 98 Caliper Guide Pin Bolts

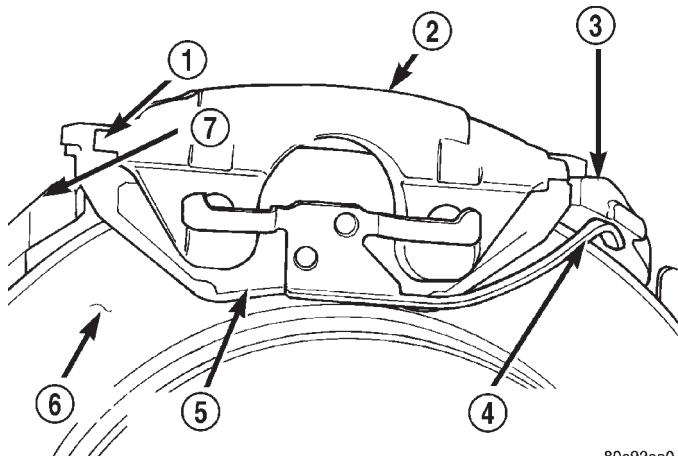
- 1 - DISC BRAKE CALIPER
- 2 - ADAPTER
- 3 - AXLE
- 4 - GUIDE PIN BOLTS
- 5 - DRIVESHAFT



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Fig. 100 Correctly Supported Caliper

- 1 - WIRE
- 2 - CALIPER
- 3 - ADAPTER
- 4 - ROTOR
- 5 - INNER FENDER



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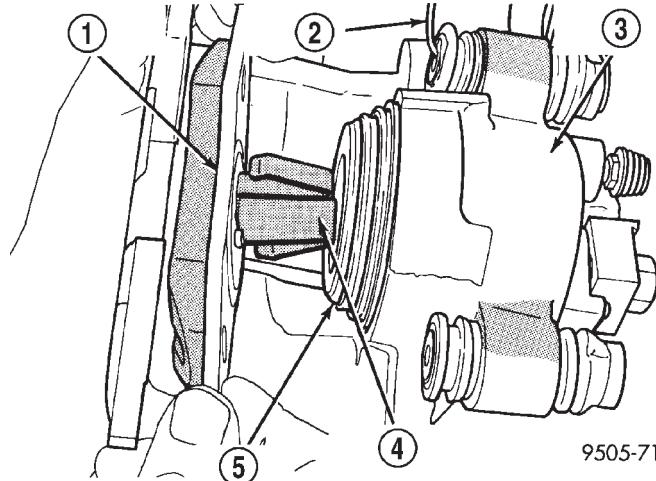
Fig. 99 Removing / Installing Caliper

- 1 - LIFT THIS END OF CALIPER AWAY FROM ADAPTER FIRST
- 2 - DISC BRAKE CALIPER
- 3 - ADAPTER ABUTMENT
- 4 - OUTBOARD BRAKE SHOE HOLD DOWN CLIP
- 5 - OUTBOARD BRAKE SHOE
- 6 - ROTOR
- 7 - ADAPTER

(6) If the brake rotor needs to be removed it can be removed by removing the retainer clips and then pulling the rotor straight off the wheel mounting studs.

(7) Remove the outboard brake shoe from the caliper. Brake shoe is removed by prying brake shoe retaining clip over raised area on caliper and sliding the brake shoe off the caliper.

(8) Remove inboard brake shoe from caliper. Inboard brake shoe is removed by pulling it out of the caliper piston, until the retaining clip is free of the piston (Fig. 101).



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Fig. 101 Removing Inboard Brake Shoe

- 1 - INBOARD BRAKE SHOE
- 2 - HANGER WIRE
- 3 - CALIPER ASSEMBLY
- 4 - RETAINING CLIP
- 5 - PISTON

CALIPER INSPECTION

Check for piston seal leaks (brake fluid in and around boot area and inboard lining) and for any ruptures of the piston dust boot. If boot is damaged, or fluid leak is visible, disassemble caliper assembly and install a new seal and boot, (and piston if

REMOVAL AND INSTALLATION (Continued)

scored). Refer to procedures titled Disc Brake Caliper Disassembly.

Check the caliper dust boot and caliper pin bushings to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Cleaning And Inspection Of Brake Caliper.

INSTALLATION

NOTE: Step 1 below is only required when installing a caliper after new brake shoes have been installed.

(1) Completely retract caliper piston back into piston bore of caliper assembly.

(2) Lubricate both adapter abutments with a liberal amount of Mopar® Multipurpose Lubricant, or equivalent.

(3) If removed, install the rear rotor on the hub, making sure it is squarely seated on the face of the hub.

(4) Install the inboard brake shoe into the caliper piston by firmly pressing it into the piston bore using your thumbs. Be sure inboard brake shoe is positioned squarely against the face of the caliper piston (Fig. 102).

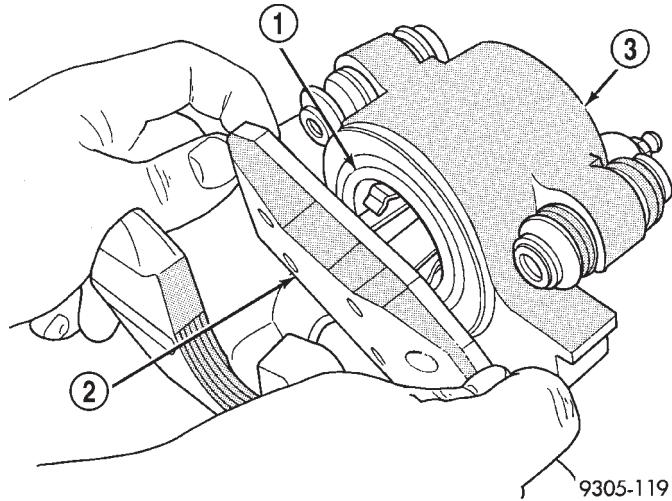


Fig. 102 Installing Inboard Brake Shoe

- 1 – PISTON
- 2 – BRAKE SHOE
- 3 – CALIPER ASSEMBLY

(5) Install the outboard brake shoe on the disc brake caliper. Be sure the outboard shoe is positioned squarely against the outboard fingers of the caliper.

CAUTION: Use care when installing the caliper assembly onto the adapter, so the caliper guide pin bushings do not get damaged by the mounting bosses.

(6) Carefully lower caliper and brake shoes over rotor and onto adapter, reversing the removal procedure (Fig. 99).

CAUTION: When installing the caliper guide pin bolts extreme caution should be taken not to crossthread the guide pin bolts.

(7) Install the caliper guide pin bolts. Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(8) Install the wheel and tire assembly.

(9) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(10) Remove jackstands or lower hoist.

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop the vehicle.

(11) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

DRUM BRAKE WHEEL CYLINDER (REAR)

REMOVE

(1) In case of a leak, remove brake shoes, (replace if soaked with grease or brake fluid.)

(2) Disconnect the rear brake hydraulic tube from the wheel cylinder (Fig. 103).

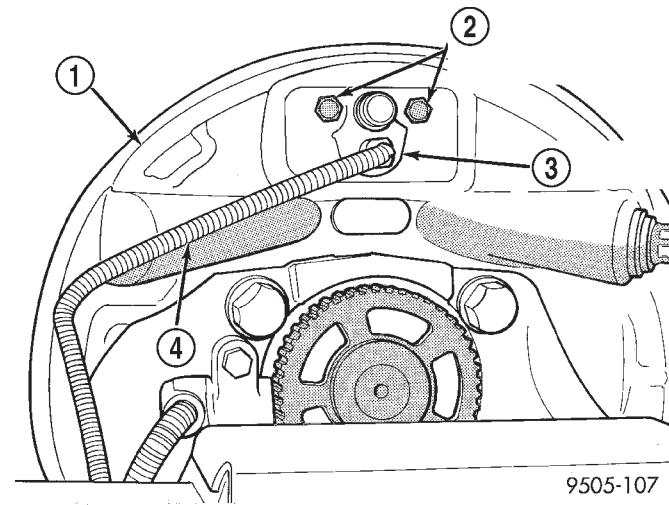


Fig. 103 Brake Hydraulic Tube At Wheel Cylinder

- 1 – BRAKE SUPPORT PLATE
- 2 – MOUNTING BOLTS
- 3 – REAR WHEEL CYLINDER
- 4 – BRAKE TUBE

REMOVAL AND INSTALLATION (Continued)

(3) Remove the rear wheel cylinder attaching bolts (Fig. 103). Then pull wheel cylinder assembly off the brake support plate.

INSTALL

(1) Apply Mopar® Gasket In-A-Tube or equivalent sealant around wheel cylinder mounting surface in brake support plate.

(2) Install wheel cylinder onto brake support, and tighten the wheel cylinder to brake support plate attaching bolts (Fig. 103) to 8 N·m (75 in. lbs.).

(3) Attach hydraulic brake tube to wheel cylinder, (Fig. 103) and tighten tube to wheel cylinder fitting to 16 N·m (142 in. lbs.).

(4) Install brake shoes on support plate.

(5) Install rear brake drum onto rear hub. Install rear wheel and tire assembly, tighten wheel stud nuts to 129 N·m (95 ft. lbs.).

(6) Adjust the rear brakes, (See Adjusting Service Brakes) in Service Adjustments section in this group of the service manual.

(7) Bleed the entire brake system. See (Bleeding Brake System) in Service Adjustments section in this group of the service manual.

DRUM BRAKE SHOES (REAR)

NOTE: Before proceeding with this procedure, review the SERVICE WARNINGS AND CAUTIONS found at the beginning of the REMOVAL AND INSTALLATION section.

REMOVAL

(1) Raise vehicle. Refer to Hoisting in the Lubrication and Maintenance section of this manual.

(2) Remove the rear wheel and tire assemblies from the vehicle.

(3) Remove rear brake drum to hub retaining clips (if equipped), then remove rear brake drums.

NOTE: When creating slack in the park brake cables by locking out the automatic adjuster, (Fig. 104) be sure that the park brake pedal is in the released (most upward) position.

(4) Create slack in the rear park brake cables. Slack is created by grabbing exposed section of front park brake cable and pulling it down and rearward. Slack is maintained in the park brake cable by installing a pair of locking pliers on the park brake cable just rearward of **only the rear** body outrigger bracket. (Fig. 104)

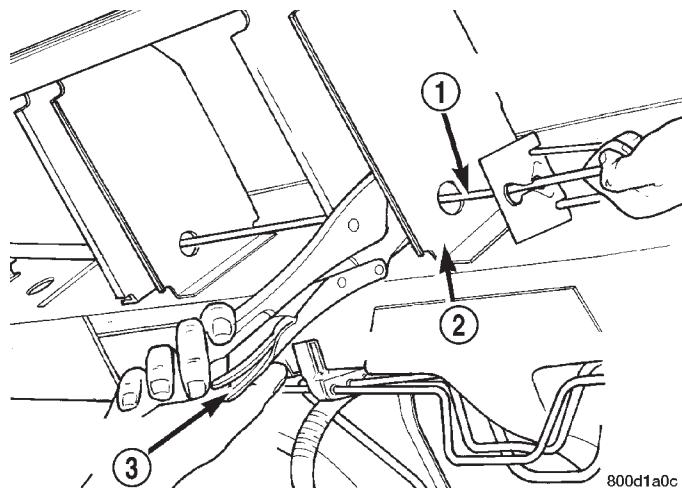


Fig. 104 Locked Out Park Brake Automatic Adjuster

- 1 – PARK BRAKE CABLE
2 – REAR BODY OUTRIGGER BRACKET
3 – LOCKING PLIERS

(5) Remove adjustment lever spring (Fig. 105) from adjustment lever and front brake shoe.

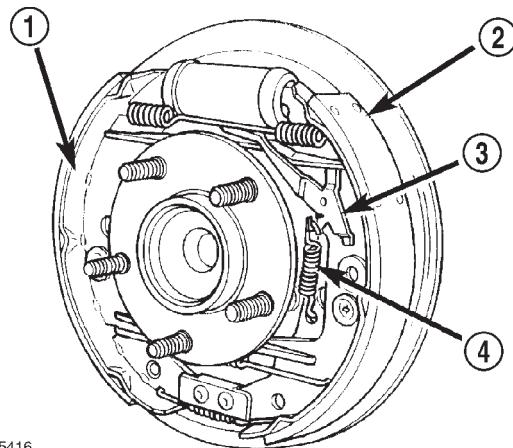


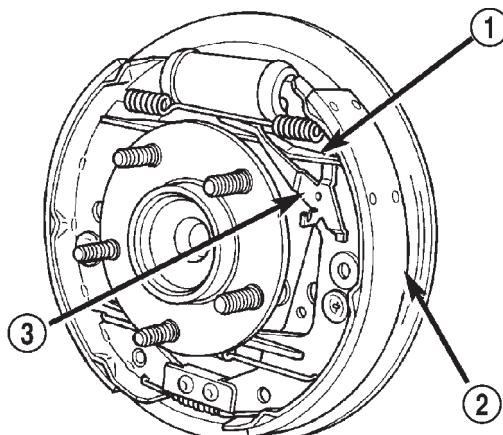
Fig. 105 Adjustment Lever Actuating Spring

- 1 – TRAILING BRAKE SHOE
2 – LEADING BRAKE SHOE
3 – AUTOMATIC ADJUSTER LEVER
4 – ADJUSTER LEVER ACTUATING SPRING

(6) Remove adjustment lever (Fig. 106) from leading brake shoe.

(7) Remove the brake shoe to brake shoe lower return springs (Fig. 107) and (Fig. 108).

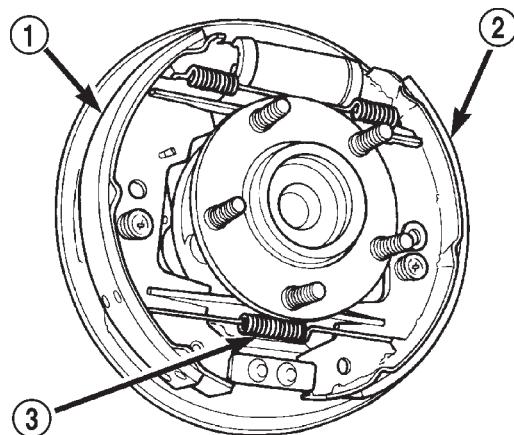
REMOVAL AND INSTALLATION (Continued)



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Fig. 106 Adjustment Lever

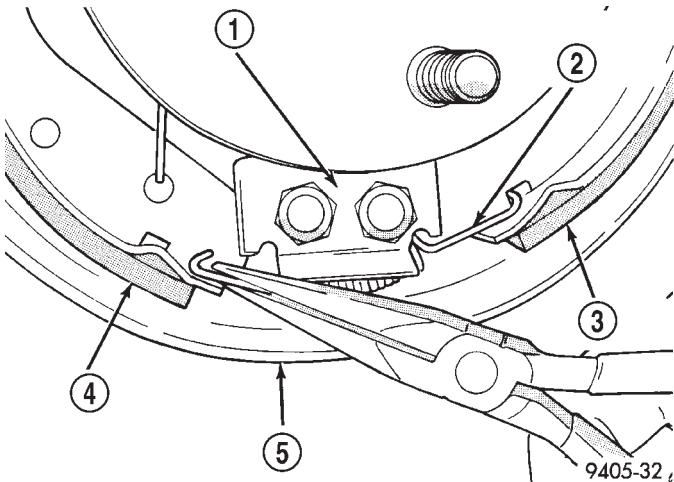
- 1 – AUTOMATIC ADJUSTER
2 – LEADING BRAKE SHOE
3 – AUTOMATIC ADJUSTER LEVER



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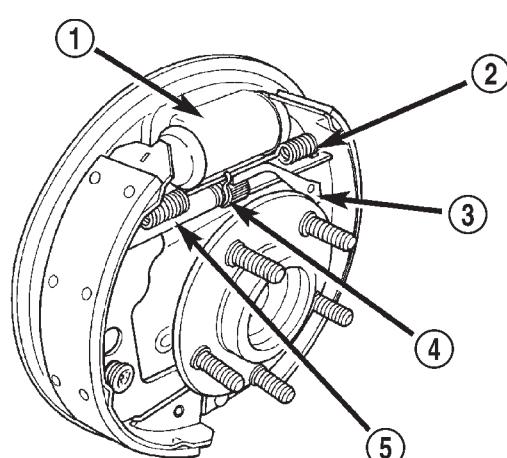
Fig. 108 Brake Shoe Lower Return Spring

- 1 – TRAILING BRAKE SHOE
2 – LEADING BRAKE SHOE
3 – RETURN SPRING

**Fig. 107 Remove/Install Brake Shoe Lower Return Spring**

- 1 – ANCHOR PLATE
2 – LOWER BRAKE SHOE RETURN SPRING
3 – REAR BRAKE SHOE
4 – FRONT BRAKE SHOE
5 – BRAKE SUPPORT PLATE

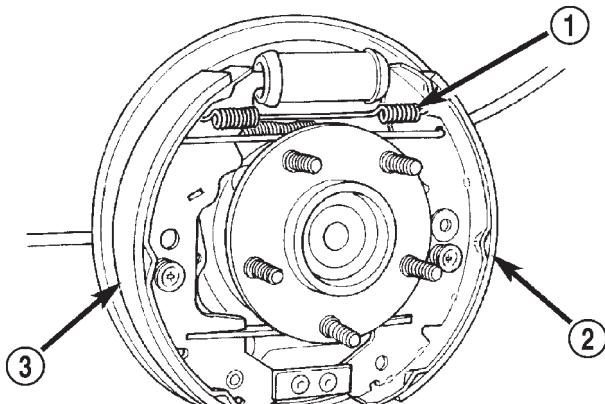
(8) Remove the tension clip (Fig. 109) attaching the upper return spring to the automatic adjuster assembly.

**Fig. 109 Tension Clip Attachment To Adjuster**

- 1 – WHEEL CYLINDER
2 – BRAKE SHOE UPPER RETURN SPRING
3 – AUTOMATIC ADJUSTER LEVER
4 – TENSION CLIP
5 – AUTOMATIC ADJUSTER ASSEMBLY

(9) Remove the brake shoe to brake shoe upper return spring (Fig. 110).

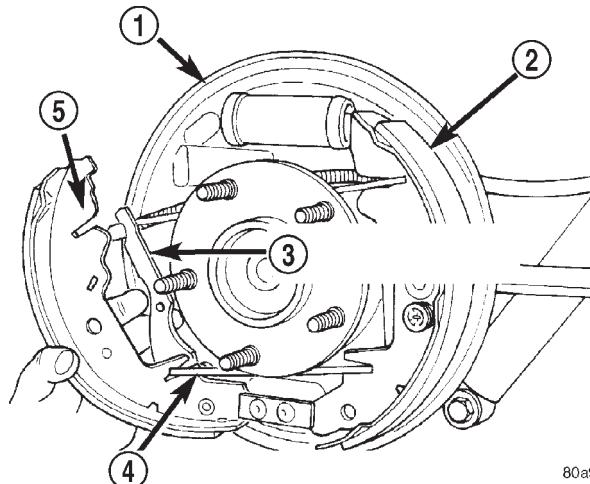
REMOVAL AND INSTALLATION (Continued)



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Fig. 110 Brake Shoe Upper Return Spring

- 1 - BRAKE SHOE RETURN SPRING
- 2 - LEADING BRAKE SHOE
- 3 - TRAILING BRAKE SHOE

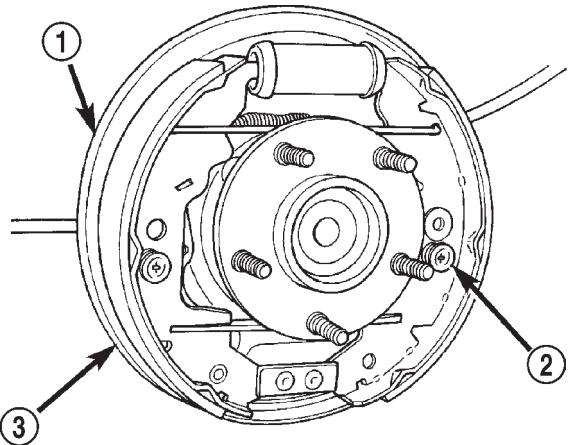


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Fig. 112 Trailing Brake Shoe Removal/Installation

- 1 - BRAKE SUPPORT PLATE
- 2 - LEADING BRAKE SHOE
- 3 - PARK BRAKE ACTUATING LEVER
- 4 - PARK BRAKE ACTUATING STRUT
- 5 - TRAILING BRAKE SHOE

(10) Remove the trailing brake shoe assembly to brake support plate hold down spring and pin (Fig. 111) from the brake shoe assembly.



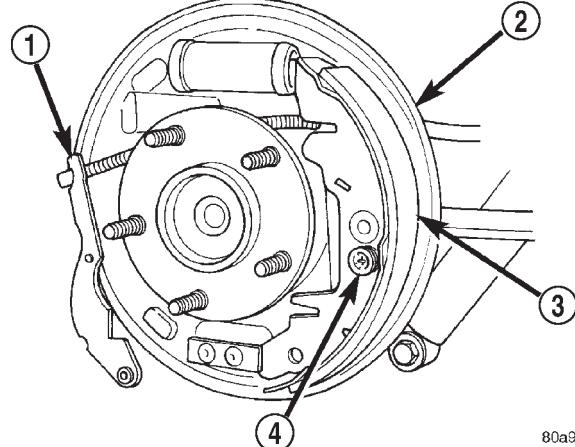
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Fig. 111 Trailing Brake Shoe Hold Down Spring And Pin

- 1 - BRAKE SUPPORT PLATE
- 2 - HOLD DOWN SPRING AND PIN
- 3 - TRAILING BRAKE SHOE

(11) Remove the trailing brake shoe assembly from the brake support plate, park brake actuating lever and park brake actuating strut (Fig. 112). Remove the automatic adjuster assembly from the leading brake shoe.

(12) Remove the leading brake shoe assembly to brake support plate hold down spring and pin (Fig. 113) from the brake shoe. Remove the leading brake shoe from the brake support plate.



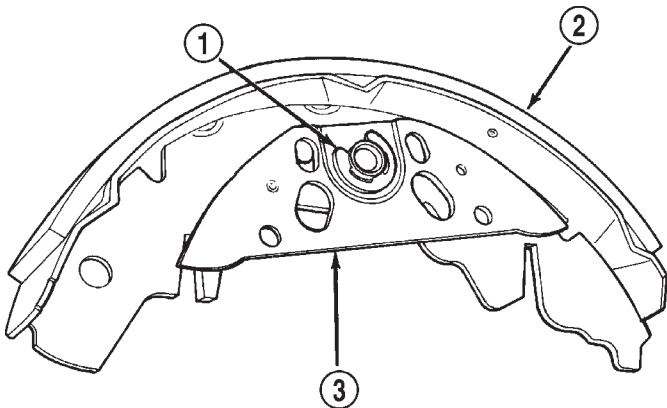
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Fig. 113 Leading Brake Shoe Hold Down Spring And Pin

- 1 - PARK BRAKE ACTUATING LEVER
- 2 - BRAKE SUPPORT PLATE
- 3 - LEADING BRAKE SHOE
- 4 - HOLD DOWN SPRING AND PIN

REMOVAL AND INSTALLATION (Continued)

(13) Remove the park brake actuator (Fig. 114) from the leading brake shoe and transfer to the replacement brake shoe.



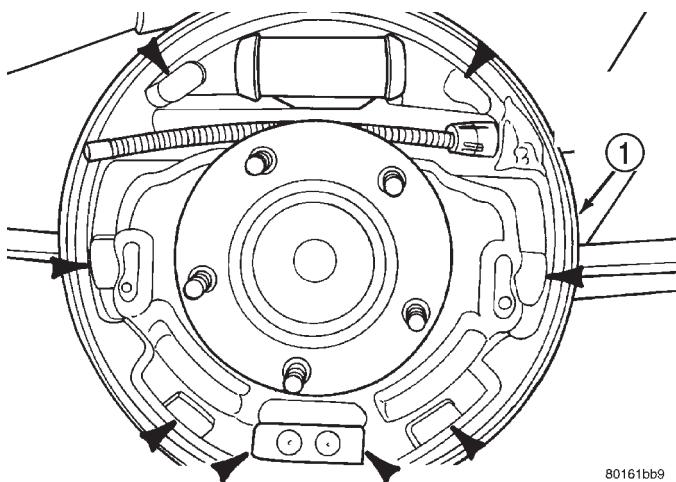
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Fig. 114 Park Brake Actuator Plate

- 1 – RETAINING CLIP
- 2 – BRAKE SHOE ASSEMBLY
- 3 – ACTUATOR PLATE

INSTALLATION

(1) Lubricate the eight shoe contact areas on the support plate and anchor, (Fig. 115) using the required special Mopar Brake Lubricant, P/N 4796269.



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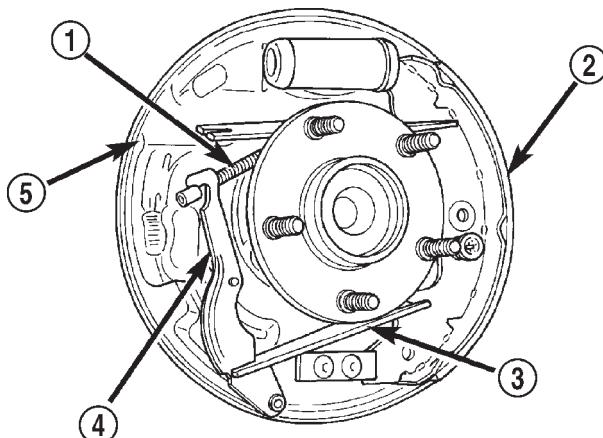
Fig. 115 Brake Support Plate Contact Areas

- 1 – REAR BRAKE SUPPORT PLATE

(2) Install leading brake shoe on brake support plate. Install the leading brake shoe hold down spring and pin (Fig. 113) on the brake shoe.

(3) Install the park brake actuator strut (Fig. 116) on the leading brake shoe. Then install the park brake actuator lever on the strut (Fig. 116).

(4) Install the automatic adjuster screw on the leading brake shoe. Then install the trailing brake



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Fig. 116 Park Brake Components Assembled On Leading Brake Shoe

- 1 – PARK BRAKE CABLE
- 2 – LEADING BRAKE SHOE
- 3 – PARK BRAKE ACTUATING STRUT
- 4 – PARK BRAKE ACTUATING LEVER
- 5 – BRAKE SUPPORT PLATE

shoe on the park brake actuating lever and park brake actuating strut (Fig. 112). Position trailing brake shoe on brake support plate.

(5) Install the brake shoe hold down pin and spring on the trailing brake shoe (Fig. 111).

(6) Install the brake shoe to brake shoe upper return spring (Fig. 110).

CAUTION: When installing the tension clip on the automatic adjuster, it must be located on only the threaded area of the adjuster assembly (Fig. 109). If it is located on a non-threaded area of the adjuster, the function of the automatic adjuster will be affected.

(7) Install the tension clip (Fig. 109) attaching the upper return spring to the automatic adjuster assembly.

(8) Install the brake shoe to brake shoe lower return springs on the brake shoes (Fig. 107) and (Fig. 108).

(9) Install automatic adjustment lever on the leading brake shoe of the rear brake assembly (Fig. 106).

(10) Install the actuating spring on the automatic adjustment lever and leading brake shoe assembly (Fig. 105).

(11) Verify that the automatic adjuster lever has positive contact with the star wheel on the automatic adjuster assembly.

(12) When all components of both rear brake assemblies are correctly and fully installed, remove the locking pliers from the front park brake cable.

(13) Adjust brake shoes assemblies so as not to interfere with brake drum installation.

REMOVAL AND INSTALLATION (Continued)

- (14) Install the rear brake drums on the hubs.
- (15) Adjust rear brake shoes per Adjusting Rear Brakes procedure in the service adjustments section of the service manual.
- (16) Install the wheel and tire assembly.
- (17) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).
- (18) Lower the vehicle.
- (19) Push the park brake pedal to the floor once and release pedal. This will automatically remove the slack from and correctly adjust the park brake cables.
- (20) Road test vehicle. The automatic adjuster will continue the brake adjustment during the road test of the vehicle.

BRAKE DRUM (REAR)

REMOVAL

- (1) Raise the vehicle. Refer to Hoisting in the Lubrication and Maintenance section of this manual.
- (2) Remove the tire and wheel assembly from the vehicle
- (3) Remove the rear brake shoe adjusting hole cover plug.
- (4) Insert a thin screwdriver into brake adjusting hole and hold adjusting lever away from notches of adjusting screw star wheel.
- (5) Insert another thin screwdriver into brake adjusting hole and engage notches of brake adjusting screw star wheel. Release brake adjustment by prying down with adjusting tool.
- (6) Remove rear brake drum from rear hub/bearing assembly.

INSTALLATION

- (1) Adjust brake shoe assemblies so as not to interfere with brake drum installation.
- (2) Install the rear brake drums on the hubs.
- (3) Adjust drum brake shoes as necessary per procedure found in the Adjustment section of this service manual group.
- (4) Install wheel and tire assembly.
- (5) Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).
- (6) Lower the vehicle.

DRUM BRAKE SUPPORT PLATE (REAR)

REMOVAL

- (1) Raise the vehicle. Refer to Hoisting in the Lubrication and Maintenance section of this service manual for required lifting procedure.
- (2) Remove wheel and tire assembly.
- (3) Remove brake drum from hub/bearing.
- (4) Remove brake shoes from brake support plate. Refer to Drum Brake Shoes (Rear) in the Removal And Installation section for the required procedure.
- (5) Disconnect the park brake cable from the park brake actuation lever.
- (6) Remove the rear wheel speed sensor (Fig. 117). This will prevent damage to the speed sensor during removal and installation of the hub/bearing. **The rear wheel speed sensor bolts to the hub/bearing. It can not be removed unless the speed sensor is removed first.**

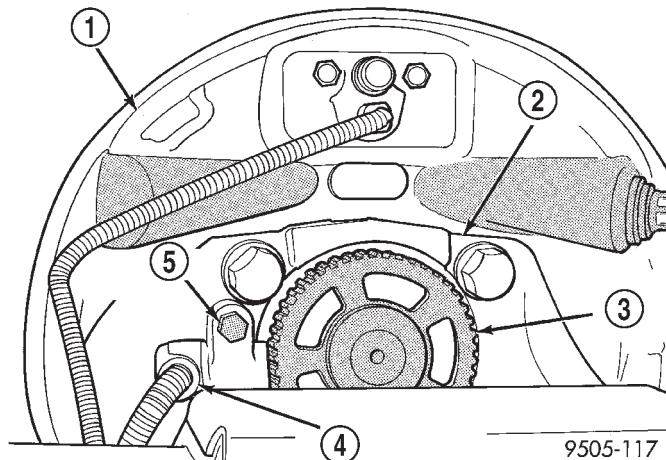


Fig. 117 Rear Wheel Speed Sensor

- 1 – BRAKE SUPPORT PLATE
 2 – REAR AXLE
 3 – TONE WHEEL
 4 – WHEEL SPEED SENSOR
 5 – MOUNTING BOLT

CAUTION: When working in the area of the rear hub/bearing and when removing it from the rear axle, care must be used so the teeth on the tone wheel are not damaged. Damage to the teeth on the tone wheel will result in false ABS cycling and corrosion of the tone wheel.

REMOVAL AND INSTALLATION (Continued)

(7) Remove the 4 bolts (Fig. 118) attaching the hub/bearing to the flange of the rear axle.

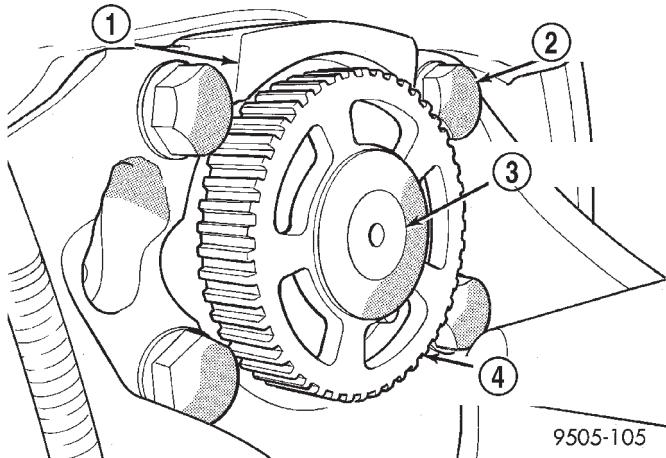


Fig. 118 Rear Hub/Bearing Mounting Bolts

- 1 – REAR AXLE FLANGE
- 2 – HUB/BEARING MOUNTING BOLTS (4)
- 3 – HUB/BEARING ASSEMBLY
- 4 – TONE WHEEL (WHEN ABS EQUIPPED)

CAUTION: Corrosion may occur between the hub/bearing and the axle. If this occurs the hub/bearing will be difficult to remove from the axle. If the hub/bearing will not come out of the axle by pulling on it by hand, do not pound on the hub/bearing to remove it from the axle. Pounding on the hub/bearing to remove it from the axle will damage the hub/bearing. This damage will result in noise or failure of the bearing.

(8) If hub/bearing cannot be removed from the axle by hand, use Remover Special Tool 8214 (Fig. 119) and following procedure to press the hub/bearing out of the axle.

(a) Place Special Tool 8214-1 over tone wheel and against cast flange of hub/bearing (Fig. 119). Put a dab of grease in the bolt pilot hole on the back of Special Tool 8214-1.

(b) Insert Special Tool 8214-2 into the hole in the bottom of the end casting on the axle (Fig. 119). Special Tool 8214-2 should be against and supported by the axle plate (Fig. 119) when pressing the wheel bearing out of the axle. **If Special Tool 8214-2 will not fit into the hole in the end casting, file or grind the flashing from the hole until tool fits properly.**

(c) Align bolt in Special Tool 8214-2 with pilot hole in Special Tool 8214-1. Tighten bolt against Special Tool 8214-1.

(d) Press hub/bearing out of axle by continuing to tighten bolt in Special Tool 8214-2 against Special Tool 8214-1.

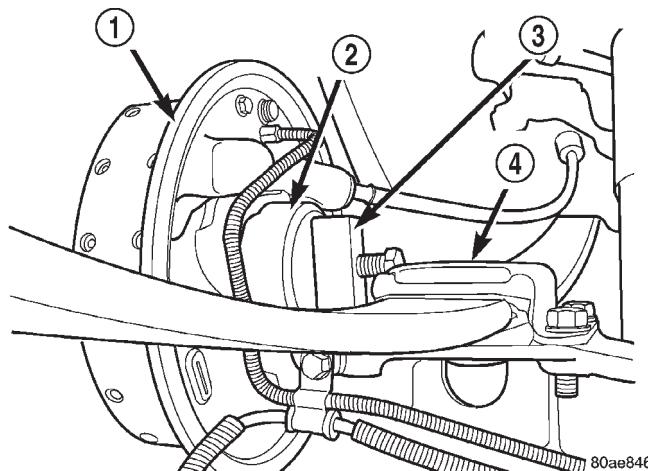


Fig. 119 Special Tool 8214 Installed

- 1 – BRAKE SUPPORT PLATE
- 2 – SPECIAL TOOL 8214-1
- 3 – SPECIAL TOOL 8214-2
- 4 – AXLE PLATE

(9) Remove the hub/bearing from the rear axle and brake support plate (Fig. 120).

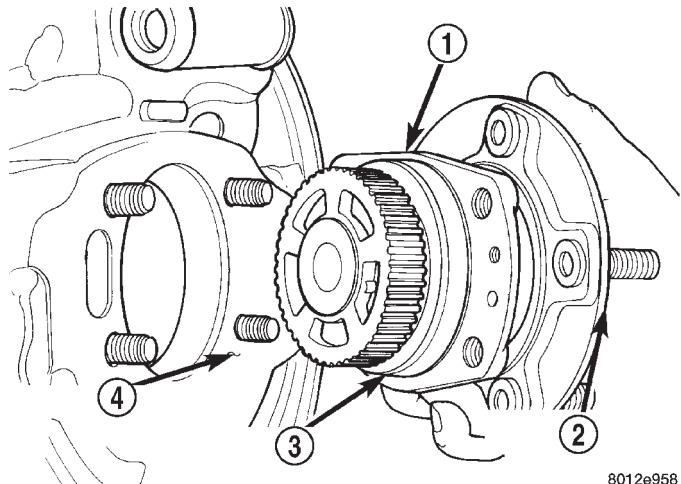


Fig. 120 Hub/Bearing Removal And Installation On Axle

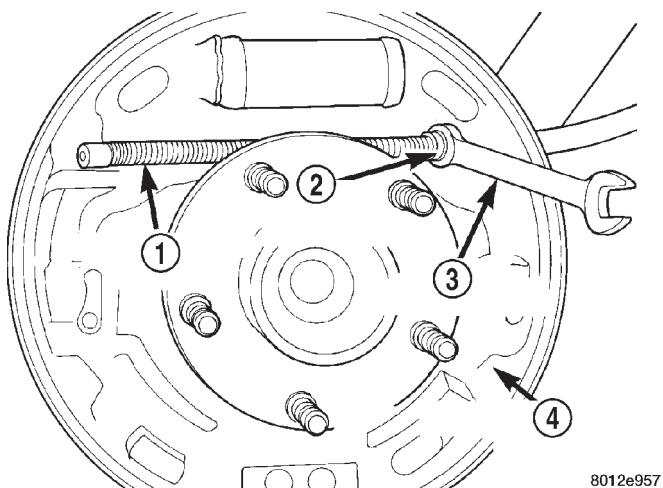
- 1 – THIN BEARING MOUNTING FLANGE
- 2 – HUB/BEARING ASSEMBLY
- 3 – THICK BEARING MOUNTING FLANGE
- 4 – BRAKE SUPPORT PLATE

(10) Using a suitable tool such as a 14 mm box wrench (Fig. 121) or an aircraft type hose clamp, compress the flared legs on park brake cable retainer. Then pull the park brake cable out of brake support plate.

(11) Lower vehicle enough to access the brake pedal.

(12) Using a brake pedal depressor, move brake pedal to a position past its first 1 inch of travel. This

REMOVAL AND INSTALLATION (Continued)



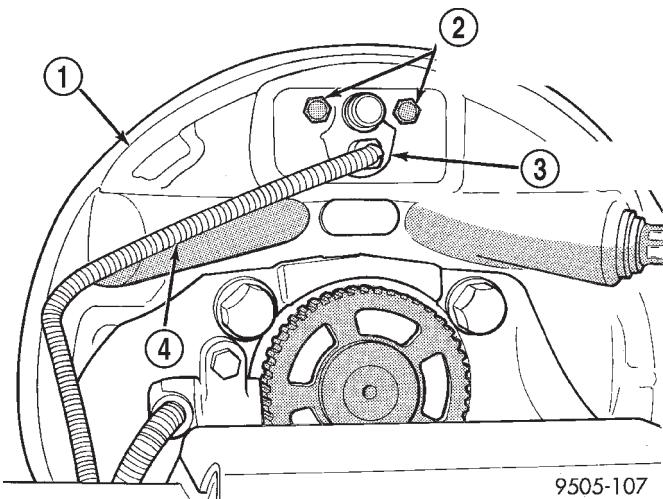
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Fig. 121 Removing Park Brake Cable From Brake Support Plate

- 1 – PARK BRAKE CABLE
- 2 – CABLE RETAINER
- 3 – 14 mm BOX WRENCH
- 4 – BRAKE SUPPORT PLATE

will prevent brake fluid from draining out of master cylinder when brake tube is removed from wheel cylinder.

- (13) Raise vehicle.
- (14) Disconnect brake tube from wheel cylinder (Fig. 122).



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Fig. 122 Rear Wheel Cylinder Mounting Bolts And Brake Tube

- 1 – BRAKE SUPPORT PLATE
- 2 – MOUNTING BOLTS
- 3 – REAR WHEEL CYLINDER
- 4 – BRAKE TUBE

- (15) Remove the 2 bolts attaching the wheel cylinder to the brake support plate (Fig. 122).

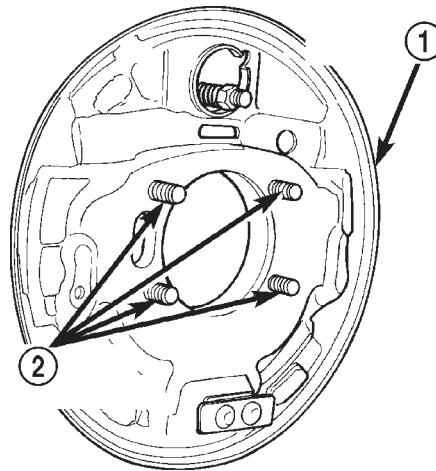
- (16) Remove the wheel cylinder from the brake support plate.

- (17) Remove the rear brake support plate from the rear axle.

INSTALLATION

- (1) Install the 4 hub/bearing to axle mounting bolts into the mounting holes in the flange of the rear axle.

- (2) Install the rear brake support plate on the 4 mounting bolts installed in the flange of the rear axle (Fig. 123).



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Fig. 123 Brake Support Plate Mounted On Bearing Attaching Bolts

- 1 – REAR BRAKE SUPPORT PLATE
- 2 – HUB/BEARING MOUNTING BOLTS

NOTE: When installing the hub/bearing on the rear axle, the bearing is to be installed with the thick bearing mounting flange (Fig. 120) pointing down.

- (3) Align the rear hub/bearing with the 4 mounting bolts and start mounting bolts into hub/bearing. Tighten the 4 bolts in a crisscross pattern until the hub/bearing and brake support plate is fully and squarely seated onto flange of rear axle.

- (4) Tighten the 4 hub/bearing mounting bolts (Fig. 118) to a torque of 129 N·m (95 ft. lbs.)

- (5) Apply sealant such as Mopar Gasket-In-A-Tube or an equivalent around the wheel cylinder opening in the brake support plate.

- (6) Install wheel cylinder onto brake support and tighten the wheel cylinder to brake support plate attaching bolts (Fig. 122) to 8 N·m (75 in. lbs.).

- (7) Install brake tube (Fig. 122) on rear wheel cylinder. Tighten tube nut to a torque of 16 N·m (142 in. lbs.).

- (8) Install the rear wheel speed sensor (Fig. 117). Install the speed sensor attaching bolt and tighten to a torque of 12 N·m (105 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

(9) Install the rear park brake cable into its mounting hole in the rear brake support plate.

(10) Install the park brake cable on the park brake actuation lever.

(11) Install the rear brake shoes on the brake support plate. Refer to Drum Brake Shoes (Rear) in this section of the service manual for the proper brake shoe installation procedure.

(12) Install brake drum onto hub/bearing.

(13) Install wheel and tire.

(14) Tighten wheel stud nuts to 135 N·m (100 ft. lbs.).

(15) Adjust the Drum Brake Shoes. Refer to Adjustments in this section.

(16) Bleed the entire brake system. See Base Brake Bleeding the Service Procedures section in this group of the service manual.

(17) Lower the vehicle.

PARKING BRAKE LEVER (PEDAL)

REMOVAL

(1) Manually release the automatic self-adjusting mechanism tension of the parking brake lever (pedal) assembly. Refer to PARKING BRAKE AUTOMATIC ADJUSTER MECHANISM RELEASE in the SERVICE PROCEDURES section of this service manual group for the required procedure.

(2) Disconnect negative (ground) cable from the battery and isolate cable from battery terminal.

(3) Remove sill scuff plate from left door sill.

(4) Remove the left side kick panel.

(5) Remove the steering column cover from the lower instrument panel.

(6) Remove the reinforcement from the lower instrument panel.

(7) Remove the front parking brake cable from the parking brake cable equalizer (Fig. 124).

(8) Remove tension from front park brake cable. Tension is removed by releasing the locking pliers from the front park brake cable.

(9) Remove the 3 bolts mounting the wiring junction block to the instrument panel.

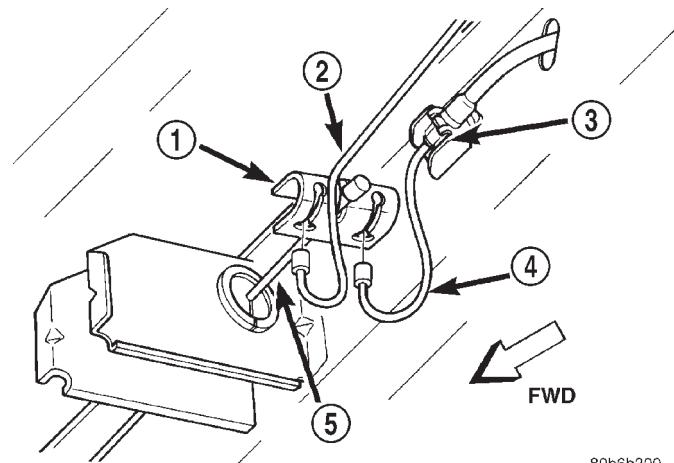
NOTE: When removing the lower mounting bolt, push the park brake pedal down 5 clicks to access the lower mounting bolt.

(10) Remove the lower bolt mounting the park brake pedal to the body.

(11) Remove the forward bolt mounting the park brake pedal to the body.

(12) Remove the upper bolt mounting the park brake pedal to the body.

(13) Disconnect the electrical connector for the brake light switch (Fig. 125).



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Fig. 124 Parking Brake Cable Equalizer

- 1 - EQUALIZER
2 - LEFT REAR PARKING BRAKE CABLE
3 - LOCKING NUT
4 - INTERMEDIATE PARKING BRAKE CABLE
5 - FRONT PARKING BRAKE CABLE

(14) Pull downward on front park brake cable while rotating park brake pedal mechanism out from behind junction block.

(15) Remove park brake pedal release cable (Fig. 125) from park brake mechanism.

(16) Remove the ground switch for the red brake warning lamp from the park brake pedal mechanism.

(17) Remove front park brake cable button from park brake pedal mechanism. Tap end housing of front park brake cable out of park brake pedal mechanism (Fig. 125).

INSTALLATION

(1) Install the ground switch for the red BRAKE warning lamp on the park brake pedal mechanism

(2) Install park brake cable end housing (Fig. 125) into park brake pedal mechanism.

(3) Install cable retainer (Fig. 125) onto the park brake cable strand and then install retainer into pedal bracket.

(4) Install cable strand button into the clevis on the park brake pedal mechanism.

(5) Install wiring harness connector on red BRAKE warning lamp ground switch.

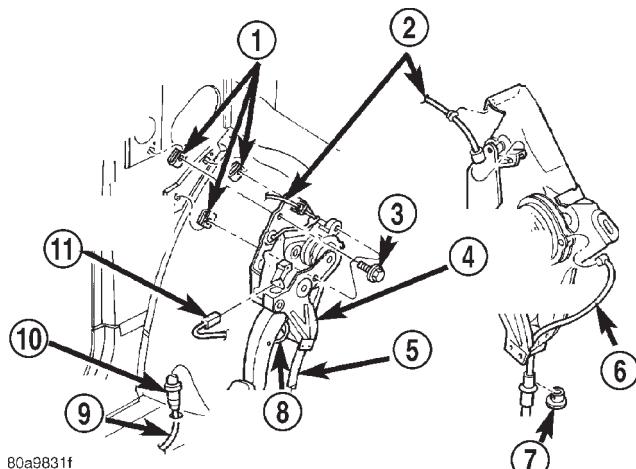
(6) Install the park brake release cable on the release mechanism of the park brake pedal.

(7) Position the park brake pedal mechanism into its installed position on the body of the vehicle.

(8) Loosely install the top bolt (Fig. 125) mounting the park brake pedal mechanism to the body.

(9) Loosely install the forward bolt (Fig. 125) mounting the park brake pedal mechanism to the body.

REMOVAL AND INSTALLATION (Continued)

**Fig. 125 Park Brake Pedal Mounting**

- 1 – J-NUTS (3)
- 2 – PARK BRAKE RELEASE CABLE
- 3 – ATTACHING BOLTS (3)
- 4 – PARK BRAKE PEDAL ASSEMBLY
- 5 – PARK BRAKE CABLE
- 6 – PARK BRAKE CABLE
- 7 – CABLE RETAINER
- 8 – PARK BRAKE AUTO-ADJUSTER LOCK-OUT PIN
- 9 – PARK BRAKE CABLE
- 10 – SEAL
- 11 – ELECTRICAL CONNECTOR

(10) Loosely install the lower bolt (Fig. 125) mounting the park brake pedal mechanism to the body.

(11) Tighten pedal mechanism attaching bolts to 28 N·m (250 in. lbs.).

(12) Verify that the park brake pedal is in the fully released (full up) position.

(13) Raise vehicle.

(14) Install the front park brake cable on the park brake cable equalizer (Fig. 124).

NOTE: If the original lever assembly is being used, the lever mechanism auto adjuster spring tension will need to be reset. Refer to PARKING BRAKE AUTOMATIC ADJUSTER MECHANISM RELEASE in the SERVICE PROCEDURES section of this service manual group for the required procedure to pull the cable into position to reconnect the cable to the equalizer bracket. After the cable to equalizer bracket connection has been made, release the pliers, thus allowing the automatic adjuster to take set.

(15) Lower vehicle.

(16) Remove the lock-out pin (Fig. 125) (if a new lever has been installed) from the automatic cable adjuster on the park brake pedal mechanism.

(17) Install the electrical junction block on the instrument panel.

(18) Install the reinforcement on the lower instrument panel.

(19) Install the steering column cover on the lower instrument panel.

(20) Install the left side kick panel.

(21) Install the sill scuff plate on the lower sill of the left door.

(22) Install the negative (ground) cable on the battery.

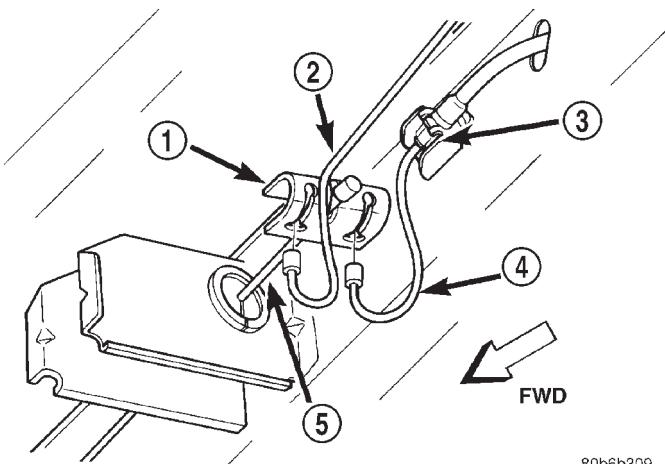
(23) Cycle the park brake pedal one time. This will seat the park brake cables and will allow the automatic self adjuster to properly tension the park brake cables.

PARKING BRAKE CABLE (FRONT)**REMOVAL**

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Manually release the automatic self-adjusting mechanism tension of the parking brake lever (pedal) assembly. Refer to PARKING BRAKE AUTOMATIC ADJUSTER MECHANISM RELEASE in the SERVICE PROCEDURES section of this service manual group for the required procedure.

(3) Remove the intermediate and left rear park brake cable from the park brake cable equalizer (Fig. 126).

**Fig. 126 Park Brake Cable Attachment To Equalizer**

- 1 – EQUALIZER
- 2 – LEFT REAR PARKING BRAKE CABLE
- 3 – LOCKING NUT
- 4 – INTERMEDIATE PARKING BRAKE CABLE
- 5 – FRONT PARKING BRAKE CABLE

REMOVAL AND INSTALLATION (Continued)

(4) Remove the front park cable housing retainer from body outrigger bracket (Fig. 127). Cable is removable by sliding a 14 mm box wrench over cable retainer and compressing the three retaining fingers. Alternate method is to use an aircraft type hose clamp and screwdriver.

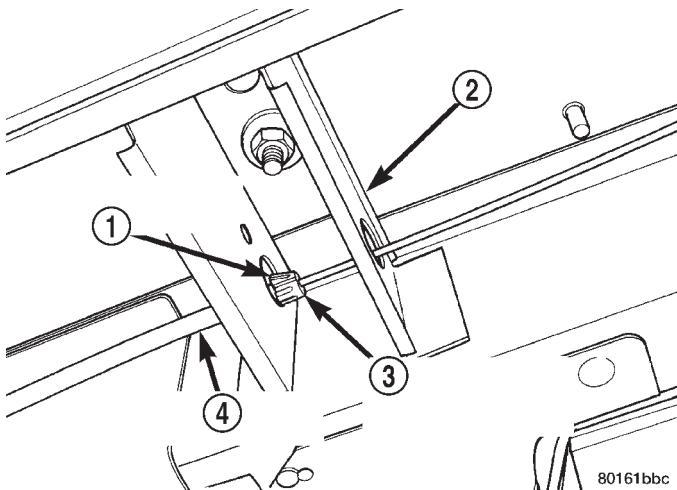


Fig. 127 Front Park Brake Cable Attachment To Body

- 1 – CABLE HOUSING RETAINER
- 2 – BODY OUTRIGGER BRACKET
- 3 – PUSH WRENCH OVER END OF RETAINER HERE
- 4 – FRONT PARK BRAKE CABLE

- (5) Lower vehicle.
- (6) Remove the left front door sill molding.
- (7) Remove the left front kick panel for access to the park brake cable and park brake pedal assembly.
- (8) Lift floor mat for access to park brake cable and floor pan. Pull the seal and the park brake cable (Fig. 128) out of the floor pan of vehicle.
- (9) Pull parking brake cable strand end forward and disconnect button from clevis. Tap cable housing end fitting out of pedal assembly bracket.
- (10) Remove cable retainer from the parking brake lever (pedal) assembly bracket.
- (11) Pull front parking brake cable assembly out of vehicle through hole in floor pan.

INSTALLATION

(1) Pass front parking brake cable assembly through hole in floor pan from the inside of the vehicle.

(2) Pass cable strand button through the hole in the lever (pedal) assembly bracket.

(3) Install cable retainer onto the park brake cable and then install cable retainer into pedal assembly bracket.

(4) Install the end of the park brake cable into the retainer previously installed into the park brake pedal bracket.

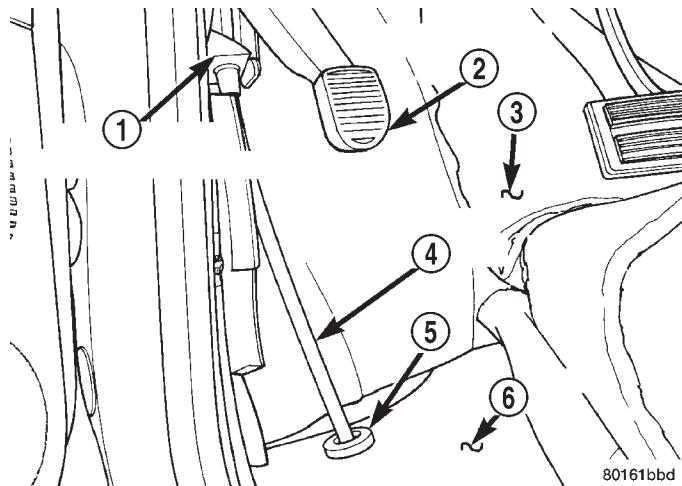


Fig. 128 Front Park Brake Cable At Floor Pan

- 1 – PARK BRAKE PEDAL ASSEMBLY
- 2 – PARK BRAKE PEDAL
- 3 – CARPET
- 4 – FRONT PARK BRAKE CABLE
- 5 – SEAL
- 6 – FLOOR PAN

(5) Install cable strand button into the clevis on the park brake pedal mechanism.

(6) Install the front park brake cable floor pan seal into hole in floor pan. Seal is to be installed so the flange on the seal is flush with the floor pan (Fig. 128). Fold carpeting back down on floor.

(7) Raise vehicle.

(8) Insert brake cable and housing into body outrigger bracket making certain that housing retainer fingers lock the housing firmly into place (Fig. 127).

(9) Manually reset the automatic self-adjusting mechanism tension of the parking brake lever (pedal) assembly. Refer to PARKING BRAKE AUTOMATIC ADJUSTER MECHANISM RELEASE in the SERVICE PROCEDURES section of this service manual group for the required procedure.

(10) Assemble the park brake cables onto the park brake cable equalizer (Fig. 126).

(11) Lower vehicle and apply the park brake pedal 1 time. This will seat the parking brake cables.

PARKING BRAKE CABLE (INTERMEDIATE)

REMOVAL

(1) Raise the vehicle. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Manually lock out the automatic self-adjusting mechanism tension of the parking brake lever (pedal) assembly. Refer to Parking Brake Automatic Adjuster Mechanism Release in the Service Procedures section of this service manual group for the required procedure. Once the cable is released from the equalizer,

REMOVAL AND INSTALLATION (Continued)

do not remove the locking pliers until reinstallation of the cable is complete.

(3) Remove the intermediate parking brake cable from the parking brake cable equalizer (Fig. 129).

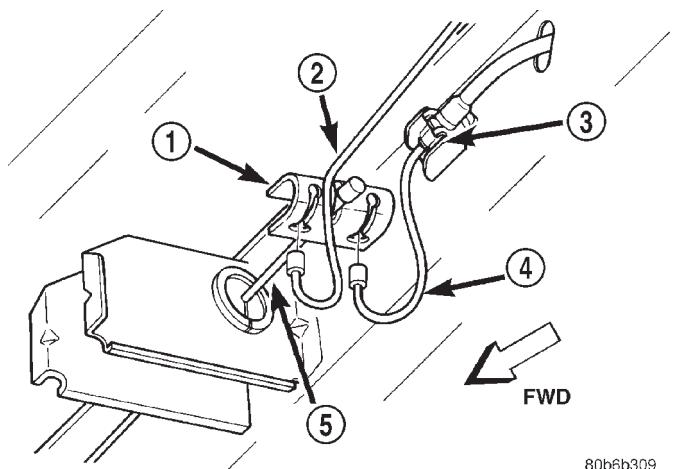


Fig. 129 Parking Brake Cable Attachment To Equalizer

- 1 – EQUALIZER
- 2 – LEFT REAR PARKING BRAKE CABLE
- 3 – LOCKING NUT
- 4 – INTERMEDIATE PARKING BRAKE CABLE
- 5 – FRONT PARKING BRAKE CABLE

(4) Remove the locking nut securing the intermediate cable housing to the side bracket on the frame rail (Fig. 129).

(5) Remove the intermediate parking brake cable from the cable connector attaching it to the right rear parking brake cable (Fig. 130). Remove the locking nut securing the intermediate cable housing to the side bracket on the frame rail (Fig. 130).

(6) If the vehicle is a short-wheel-base model, it will be necessary to loosen and lower the fuel tank far enough to remove the intermediate parking brake cable. Refer to the Fuel System group for the proper procedure.

(7) Remove the intermediate parking brake cable from the side brackets and vehicle.

INSTALLATION

(1) Install the ends of the park brake cables through the frame rails and into the side brackets.

(2) Install the locking nuts at each end of the cable and securely tighten (Fig. 129) (Fig. 130).

(3) If the vehicle is a short-wheel-base model, it will be necessary to reinstall the fuel tank to its normal mounting position. Refer to the Fuel System group for the proper procedure.

(4) Install the intermediate parking brake cable on the cable connector at the right rear parking brake cable (Fig. 130).

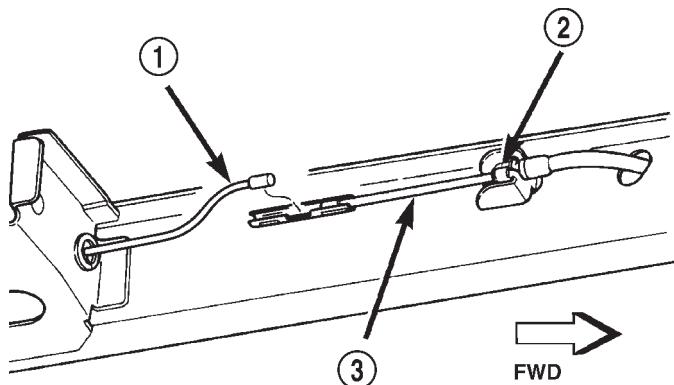


Fig. 130 Intermediate Cable Attachment To Right Rear Cable

- 1 – RIGHT REAR PARKING BRAKE CABLE
- 2 – LOCKING NUT
- 3 – INTERMEDIATE PARKING BRAKE CABLE

(5) Install the intermediate park brake cable on the cable equalizer (Fig. 129).

(6) Remove the locking pliers from the front park brake cable. This will activate the automatic adjuster and correctly adjust the parking brake cables.

(7) Install and position the foam collar on the parking brake cable to prevent it from rattling against the vehicle's floor.

(8) Lower the vehicle and apply the park brake pedal 1 time, this will seat the park brake cables.

PARKING BRAKE CABLE (RIGHT REAR)

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Remove rear tire and wheel assembly.

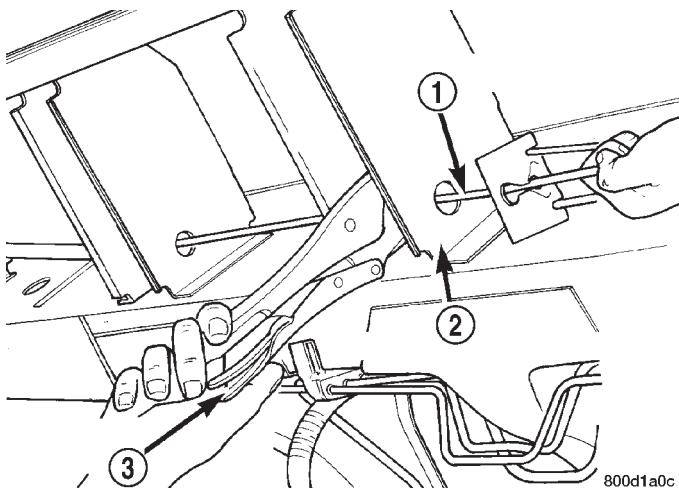
(3) Remove rear brake drum from the rear wheel of the vehicle requiring service to the rear park brake cable.

(4) Create slack in the rear parking brake cables by locking out the automatic adjuster as described here. Grasp an exposed section of front parking brake cable near the equalizer and pull down on it. At this time install a pair of locking pliers on the cable just rearward of the second body outrigger bracket (Fig. 131).

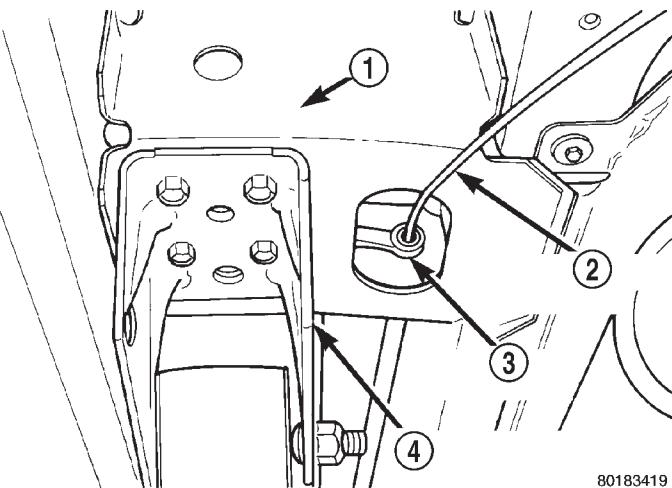
(5) Disconnect the right rear parking brake cable from the connector on the intermediate cable (Fig. 132).

(6) To remove the right parking brake cable housing from the body bracket, slide a 14 mm box end wrench over the end of cable retainer to compress the retaining fingers (Fig. 133). The alternate method

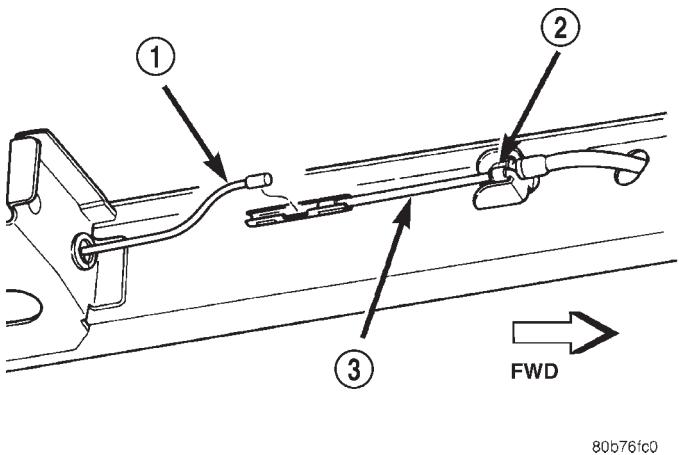
REMOVAL AND INSTALLATION (Continued)

**Fig. 131 Locking Out Automatic Adjuster**

- 1 – PARK BRAKE CABLE
2 – REAR BODY OUTRIGGER BRACKET
3 – LOCKING PLIERS

**Fig. 133 Right Park Brake Cable Removal From Body Bracket**

- 1 – RIGHT REAR BODY BRACKET
2 – PARK BRAKE CABLE
3 – 14mm WRENCH
4 – LEAF SPRING AND BRACKET

**Fig. 132 Right Rear Cable Connection To Intermediate Cable**

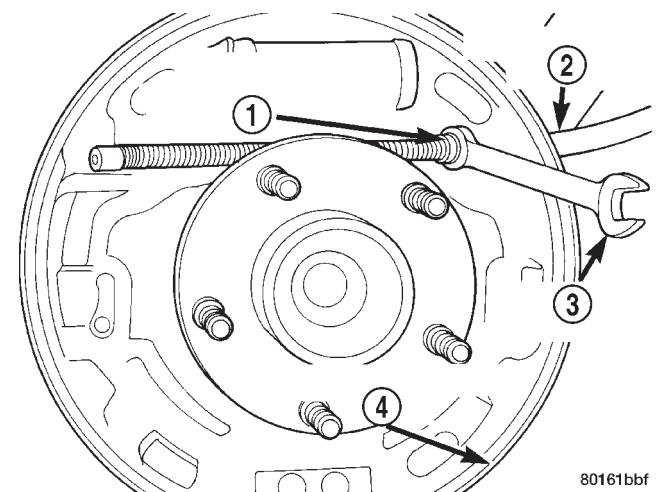
- 1 – RIGHT REAR PARKING BRAKE CABLE
2 – LOCKING NUT
3 – INTERMEDIATE PARKING BRAKE CABLE

using an aircraft type hose clamp will not work on the right side of the vehicle.

(7) Remove the brake shoes from the brake support plate. Refer to REAR BRAKE SHOES in the REMOVAL AND INSTALLATION section of this service manual for the required procedure.

(8) Disconnect parking brake cable from parking brake actuator lever.

(9) Remove the parking brake cable housing retainer from the brake support plate using a 14mm wrench to compress the retaining fingers (Fig. 134). Remove the cable.

**Fig. 134 Removing Park Brake Cable From Brake Support Plate**

- 1 – PARK BRAKE CABLE RETAINER
2 – PARK BRAKE CABLE
3 – 14MM BOX WRENCH
4 – BRAKE SUPPORT PLATE

INSTALLATION

(1) Install the rear parking brake cable in the brake support plate. Insert cable housing retainer into brake support plate making certain that cable housing retainer fingers lock the housing and retainer firmly into place.

(2) Attach the parking brake cable onto the parking brake actuator lever.

REMOVAL AND INSTALLATION (Continued)

(3) Install the brake shoes on the rear brake support plate. Refer to REAR BRAKE SHOES in the REMOVAL AND INSTALLATION Section of this service manual for the required procedure.

(4) Insert cable housing retainer into body outrigger bracket making certain that cable housing retainer fingers lock the housing firmly into place.

(5) Connect the right rear parking brake cable to the connector on the intermediate parking brake cable (Fig. 132).

(6) Install the brake drum, then the wheel and tire assembly.

(7) Remove the locking pliers from the front park brake cable. This will automatically adjust the park brake cables.

(8) Lower the vehicle.

(9) Apply and release park brake pedal 1 time. This will seat the park brake cables.

PARKING BRAKE CABLE (LEFT REAR)

REMOVAL

(1) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication and Maintenance group of this service manual.

(2) Remove rear tire and wheel assembly.

(3) Remove rear brake drum from the rear wheel of the vehicle requiring service to the rear park brake cable.

(4) Create slack in rear park brake cables by locking out the automatic adjuster as described here. Grasp an exposed section of front park brake cable near the equalizer and pull down on it. Then install a pair of locking pliers on the cable just rearward of the second body outrigger bracket (Fig. 135).

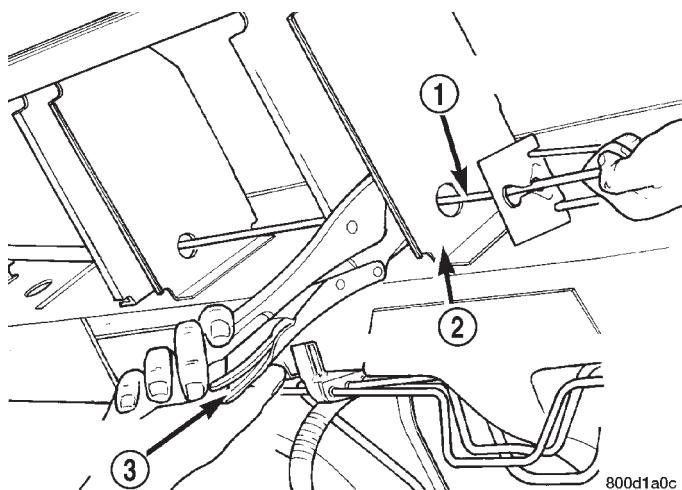


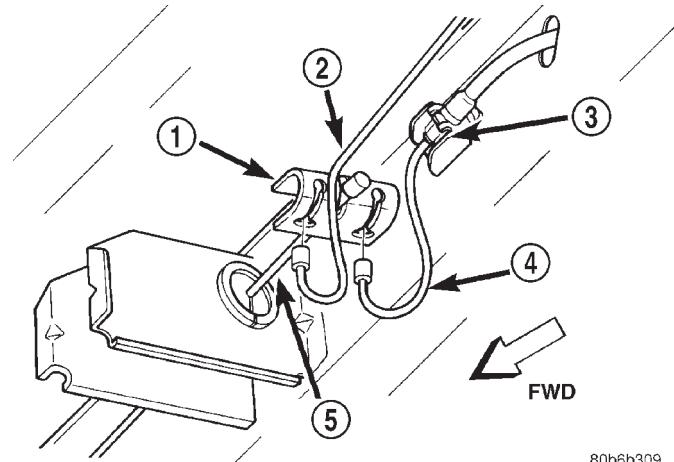
Fig. 135 Locked Out Park Brake Automatic Adjuster

1 - PARK BRAKE CABLE

2 - REAR BODY OUTRIGGER BRACKET

3 - LOCKING PLIERS

(5) Disconnect the left rear parking brake cable from the parking brake cable equalizer (Fig. 136).



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Fig. 136 Parking Brake Cables At Equalizer

1 - EQUALIZER

2 - LEFT REAR PARKING BRAKE CABLE

3 - LOCKING NUT

4 - INTERMEDIATE PARKING BRAKE CABLE

5 - FRONT PARKING BRAKE CABLE

(6) To remove parking brake cable housing from the body bracket, slide a 14 mm box end wrench over retainer end compressing the three fingers (Fig. 137). Alternate method is to use an aircraft type hose clamp.

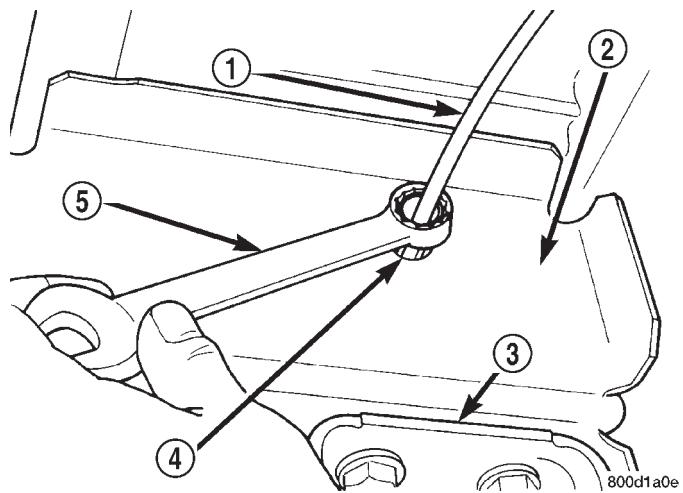


Fig. 137 Parking Brake Cable Removal From Body Bracket

1 - LEFT REAR PARK BRAKE CABLE

2 - BODY BRACKET

3 - LEAF SPRING MOUNTING BRACKET

4 - CABLE RETAINER

5 - 14mm BOX WRENCH

REMOVAL AND INSTALLATION (Continued)

(7) Remove the brake shoes from the brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section of this service manual for the required procedure.

(8) Disconnect parking brake cable from parking brake actuator lever.

(9) Remove the parking brake cable housing retainer from the brake support plate using a 14mm wrench to compress the retaining fingers (Fig. 138).

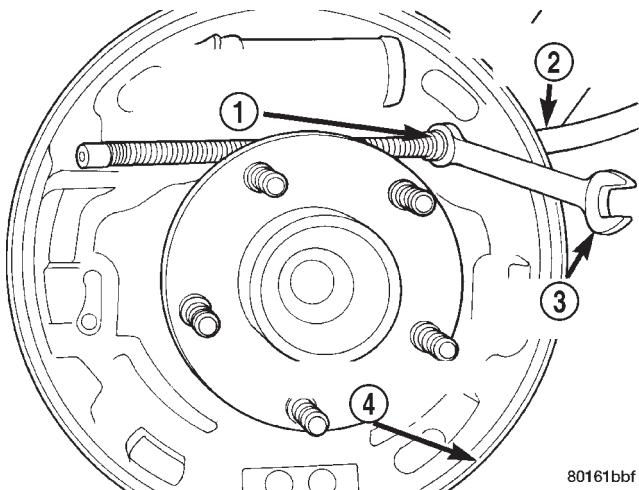


Fig. 138 Removing Parking Brake Cable From Brake Support Plate

- 1 – PARK BRAKE CABLE RETAINER
- 2 – PARK BRAKE CABLE
- 3 – 14MM BOX WRENCH
- 4 – BRAKE SUPPORT PLATE

INSTALLATION

(1) Install the rear parking brake cable in the brake support plate. Insert cable housing retainer into brake support plate making certain that cable housing retainer fingers lock the housing and retainer firmly into place.

(2) Attach the parking brake cable onto the park brake actuator lever.

(3) Install the brake shoes on the rear brake support plate. Refer to Rear Brake Shoes in the Removal And Installation Section of this service manual for the required procedure.

(4) Insert cable housing retainer into body outrigger bracket making certain that cable housing retainer fingers lock the housing firmly into place.

(5) Connect rear parking brake cable to the equalizer bracket (Fig. 136).

(6) Install brake drum, and wheel and tire assembly.

(7) Remove the locking pliers from the front park brake cable. This will automatically adjust the park brake cables.

(8) Apply and release park brake pedal 1 time. This will seat the park brake cables.

PARKING BRAKE SHOES (WITH REAR DISC BRAKES)

REMOVAL

(1) Set the parking brake. **The parking brake is set to keep the hub/bearing and axle shaft from rotating when loosening the hub nut.**

(2) Raise vehicle. See Hoisting in the Lubrication And Maintenance section of this service manual.

(3) Remove the wheel and tire assembly.

(4) Remove the cotter pin and nut retainer (Fig. 139) from the stub shaft of the outer C/V joint.

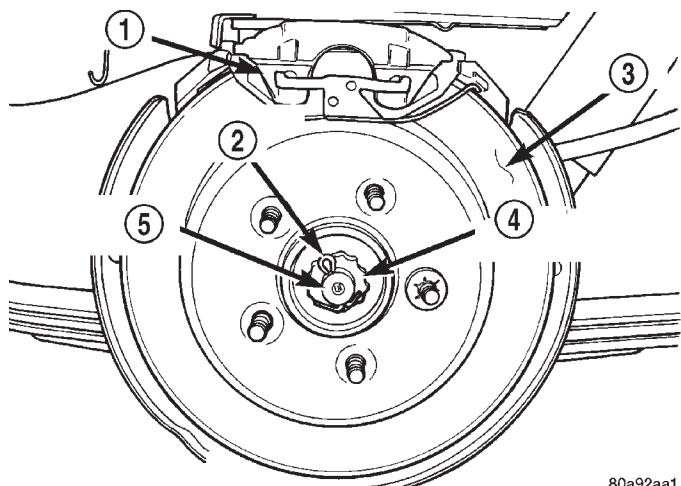


Fig. 139 Cotter Pin And Nut Retainer

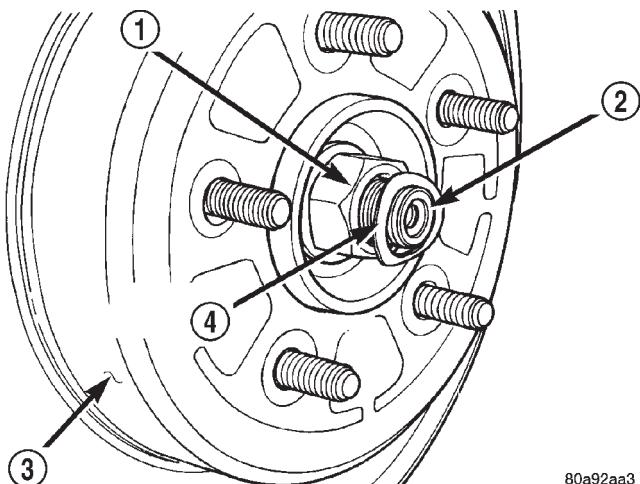
- 1 – CALIPER
- 2 – COTTER PIN
- 3 – ROTOR
- 4 – NUT RETAINER
- 5 – OUTER C/V JOINT

(5) Remove the spring washer (Fig. 140) from the stub shaft of the outer C/V joint.

(6) Remove the hub nut and washer (Fig. 141) from the stub shaft of the outer C/V joint.

(7) Release the parking brake.

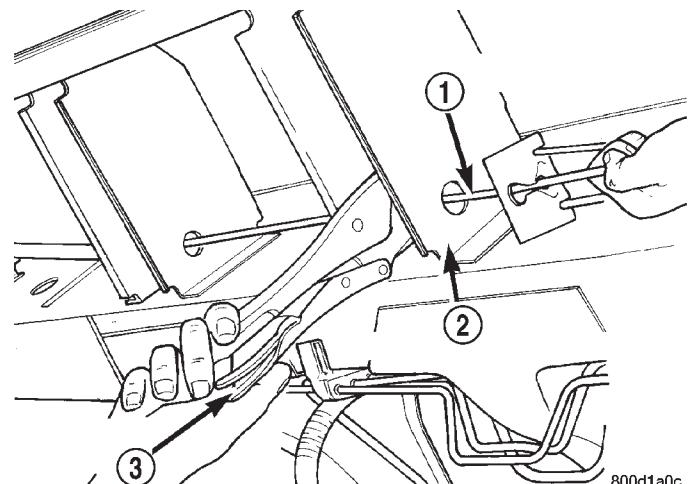
REMOVAL AND INSTALLATION (Continued)



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Fig. 140 Spring Washer

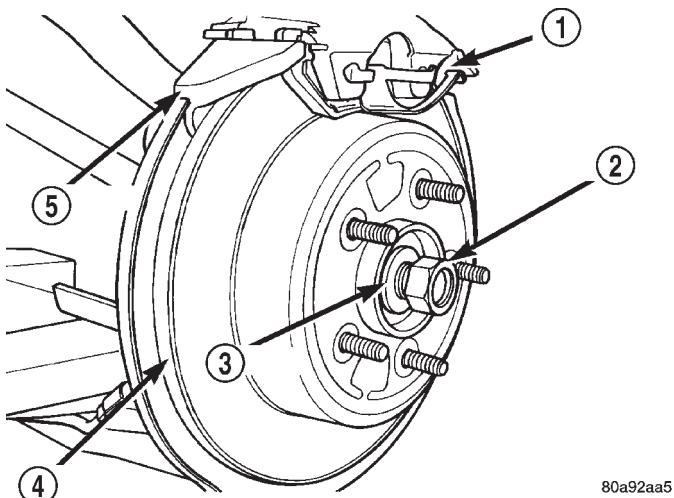
- 1 – HUB NUT
2 – STUB SHAFT
3 – ROTOR
4 – SPRING WASHER



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Fig. 142 Locking Out Automatic Adjuster

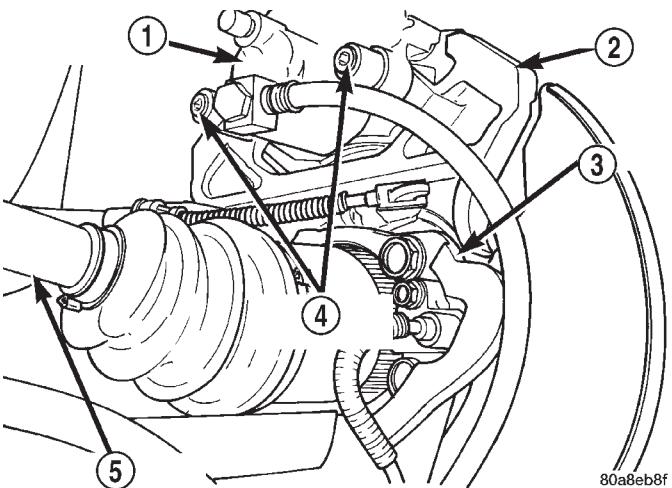
- 1 – PARK BRAKE CABLE
2 – REAR BODY OUTRIGGER BRACKET
3 – LOCKING PLIERS



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Fig. 141 Hub Nut And Washer

- 1 – CALIPER
2 – HUB NUT
3 – WASHER
4 – ROTOR
5 – ADAPTER



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Fig. 143 Removing Caliper Guide Pin Bolts

- 1 – DISC BRAKE CALIPER
2 – ADAPTER
3 – AXLE
4 – GUIDE PIN BOLTS
5 – DRIVESHAFT

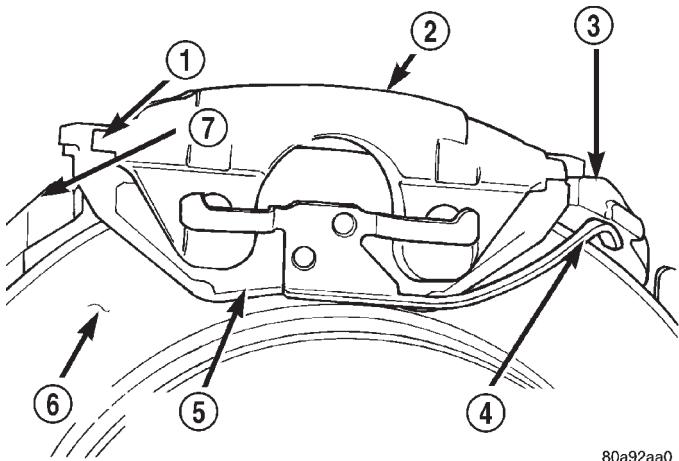
(8) Create slack in the rear park brake cables by locking the out the automatic adjuster as described. Grasp the exposed section of front park brake cable and pull downward on it. Then install a pair of locking pliers on the front park brake cable just rearward of the second body outrigger bracket (Fig. 142).

(9) Remove the disc brake caliper to adapter guide pin bolts (Fig. 143).

(10) Remove rear caliper from adapter using the following procedure. First rotate rear of caliper up from the adapter. Then pull the front of the caliper and the outboard brake shoe anti-rattle clip out from under the front abutment on the adapter (Fig. 144).

(11) Support caliper to prevent the weight of the caliper from damaging the flexible brake hose (Fig. 145).

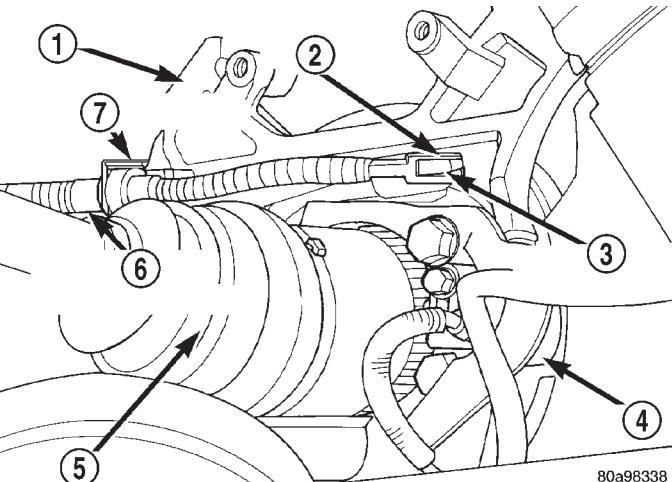
REMOVAL AND INSTALLATION (Continued)



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Fig. 144 Removing/Installing Caliper

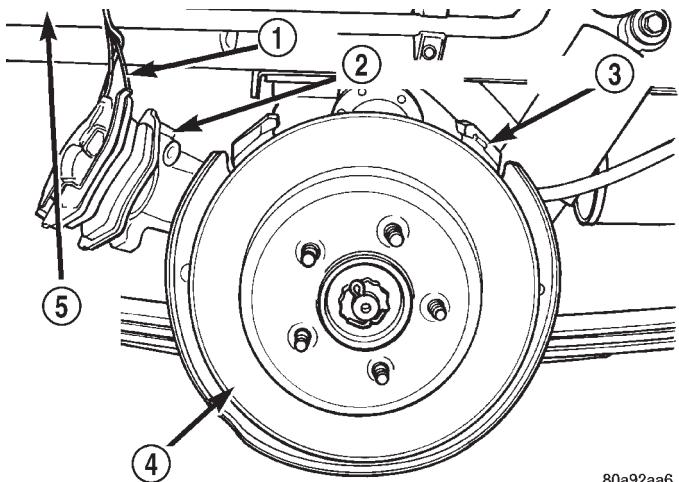
- 1 - LIFT THIS END OF CALIPER AWAY FROM ADAPTER FIRST
- 2 - DISC BRAKE CALIPER
- 3 - ADAPTER ABUTMENT
- 4 - OUTBOARD BRAKE SHOE HOLD DOWN CLIP
- 5 - OUTBOARD BRAKE SHOE
- 6 - ROTOR
- 7 - ADAPTER



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Fig. 146 Park Brake Cable Attachment To Actuator

- 1 - ADAPTER
- 2 - PARK BRAKE CABLE
- 3 - ACTUATOR
- 4 - AXLE
- 5 - DRIVESHAFT
- 6 - PARK BRAKE CABLE RETAINER
- 7 - HORSESHOE CLIP



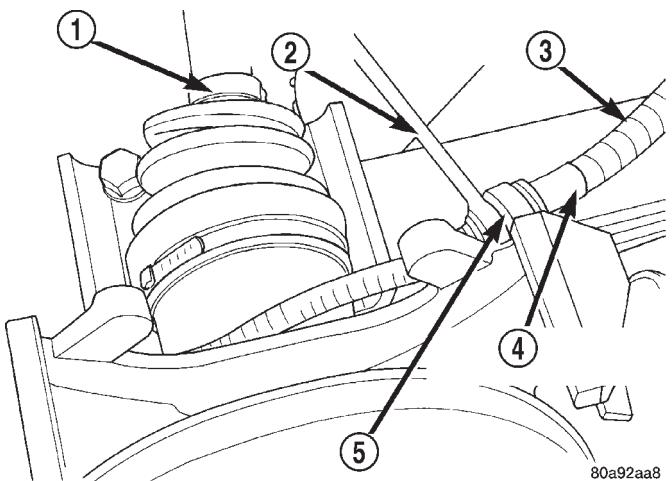
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Fig. 145 Correctly Supported Caliper

- 1 - WIRE
- 2 - CALIPER
- 3 - ADAPTER
- 4 - ROTOR
- 5 - INNER FENDER

- (12) Remove the rotor from the hub/bearing.
- (13) Remove the horseshoe clip (Fig. 146) from the retainer on the end of the park brake cable.
- (14) Remove the end of the park brake cable from the actuator lever on the adapter (Fig. 146).
- (15) Remove the end of the park brake cable from the adapter. Park brake cable is removed from adapter using a 1/2 wrench slipped over the park brake cable retainer as show in (Fig. 147) to com-

press the locking tabs on the park brake cable retainer.



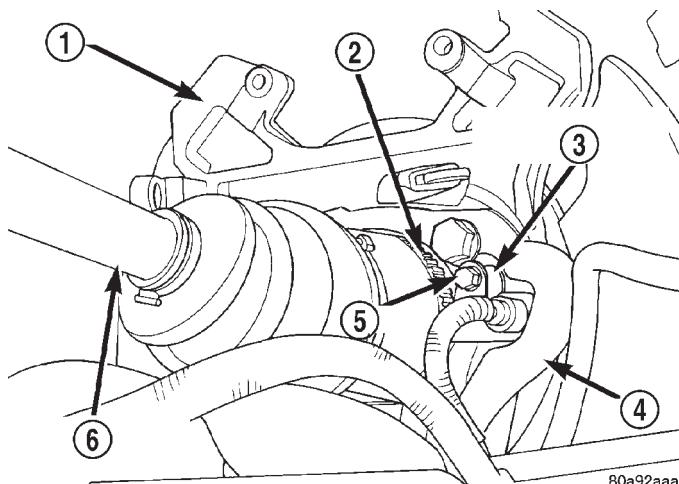
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Fig. 147 Park Brake Cable Removal From Adapter

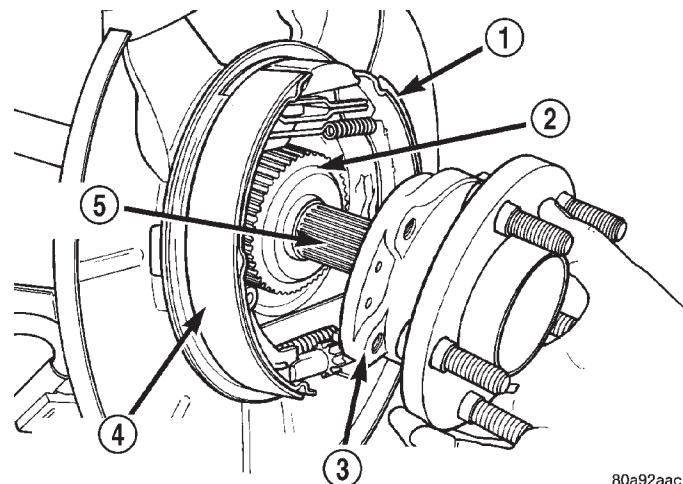
- 1 - DRIVESHAFT
- 2 - 1/2" WRENCH
- 3 - PARK BRAKE CABLE
- 4 - PARK BRAKE CABLE RETAINER
- 5 - ADAPTER

- (16) Remove the attaching bolt from the wheel speed sensor (Fig. 148). Then remove wheel speed sensor from hub/bearing and adapter.
- (17) Remove the hub/bearing to axle mounting bolts (Fig. 149).

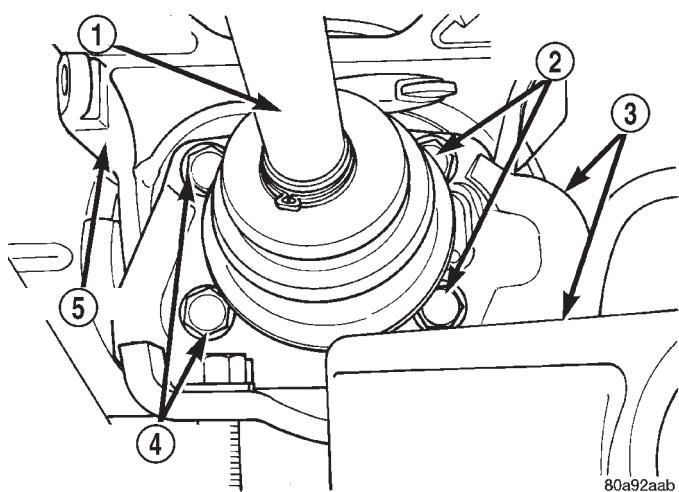
REMOVAL AND INSTALLATION (Continued)

**Fig. 148 Speed Sensor Attaching Bolt**

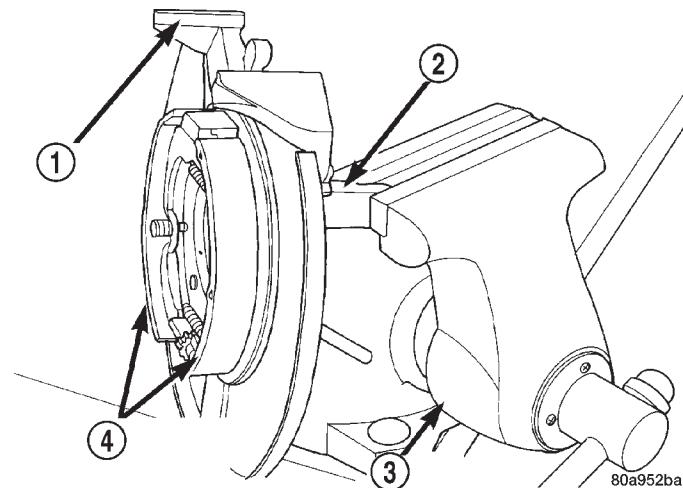
- 1 - ADAPTER
- 2 - TONE WHEEL
- 3 - WHEEL SPEED SENSOR
- 4 - AXLE
- 5 - BOLT
- 6 - DRIVESHAFT

**Fig. 150 Hub/Bearing Removal And Installation**

- 1 - PARK BRAKE BRAKE SHOE
- 2 - OUTER C/V JOINT
- 3 - HUB/BEARING
- 4 - PARK BRAKE BRAKE SHOE
- 5 - STUB SHAFT

**Fig. 149 Hub/Bearing Mounting Bolts**

- 1 - DRIVESHAFT
- 2 - MOUNTING BOLTS
- 3 - AXLE
- 4 - MOUNTING BOLTS
- 5 - ADAPTER

**Fig. 151 Adapter Mounted In Vise**

- 1 - ADAPTER
- 2 - PARK BRAKE CABLE BOSS
- 3 - VISE
- 4 - PARK BRAKE BRAKE SHOES

(18) Remove the hub/bearing from the axle and the stub shaft of the outer C/V joint (Fig. 150).

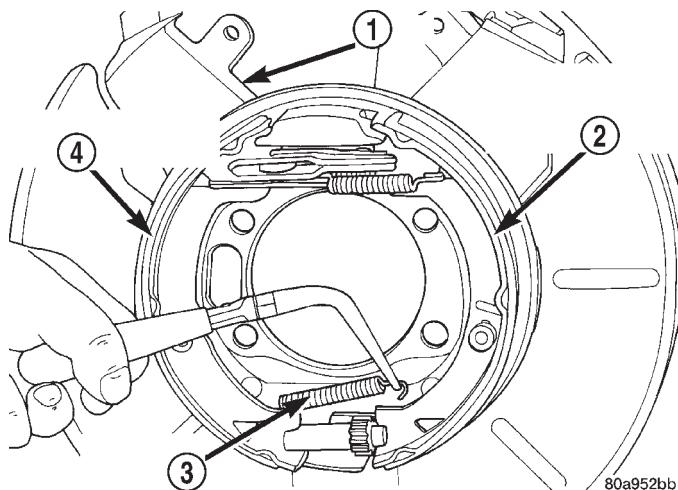
(19) Remove the adapter from the rear axle.

(20) Mount the adapter in a vise using the anchor boss for the park brake cable (Fig. 151).

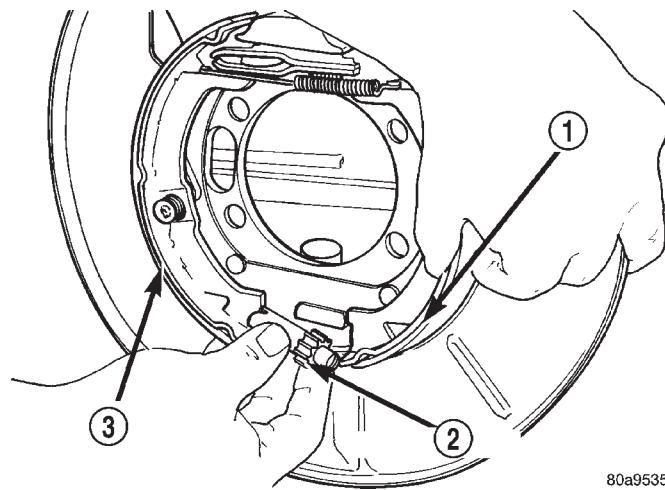
(21) Remove the lower return spring (Fig. 152) from the leading and trailing park brake shoes.

(22) Remove the hold down spring and pin (Fig. 153) from the leading park brake shoe.

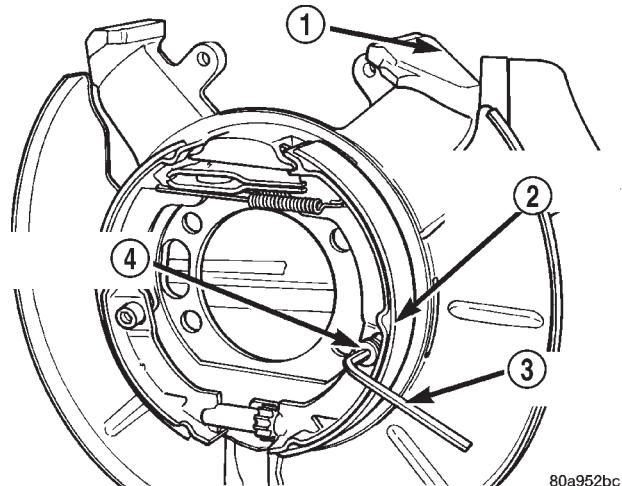
REMOVAL AND INSTALLATION (Continued)

**Fig. 152 Lower Return Spring**

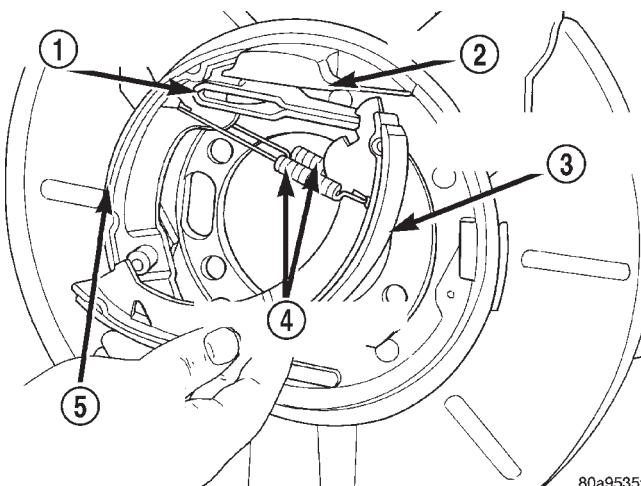
- 1 – ADAPTER
- 2 – LEADING PARK BRAKE SHOE
- 3 – RETURN SPRING
- 4 – TRAILING PARK BRAKE SHOE

**Fig. 154 Brake Shoe Adjuster**

- 1 – LEADING PARK BRAKE SHOE
- 2 – ADJUSTER
- 3 – TRAILING PARK BRAKE SHOE

**Fig. 153 Leading Brake Shoe Hold Down Pin And Spring**

- 1 – ADAPTER
- 2 – LEADING PARK BRAKE SHOE
- 3 – ALLEN WRENCH
- 4 – HOLD DOWN SPRING/PIN

**Fig. 155 Primary Brake Shoe Remove/Install**

- 1 – PARK BRAKE ACTUATOR
- 2 – ANCHOR
- 3 – LEADING PARK BRAKE SHOE
- 4 – UPPER RETURN SPRINGS
- 5 – TRAILING PARK BRAKE SHOE

(23) Remove the adjuster (Fig. 154) from the leading and trailing park brake shoe.

(24) Remove the leading park brake shoe (Fig. 155) from the adapter. Leading brake shoe is removed by rotating the bottom of the brake shoe inward (Fig. 155) until the top of the brake shoe can be removed from the brake shoe anchor. Then remove the upper return springs (Fig. 155) from the leading brake shoe.

(25) Remove the upper return springs (Fig. 156) from the trailing park brake shoe.

(26) Remove the hold down spring and pin (Fig. 157) from the trailing park brake shoe.

(27) Remove the trailing park brake shoe from the adapter.

(28) Remove the park brake shoe actuator from the adapter and inspect for signs of abnormal wear and binding at the pivot point.

REMOVAL AND INSTALLATION (Continued)

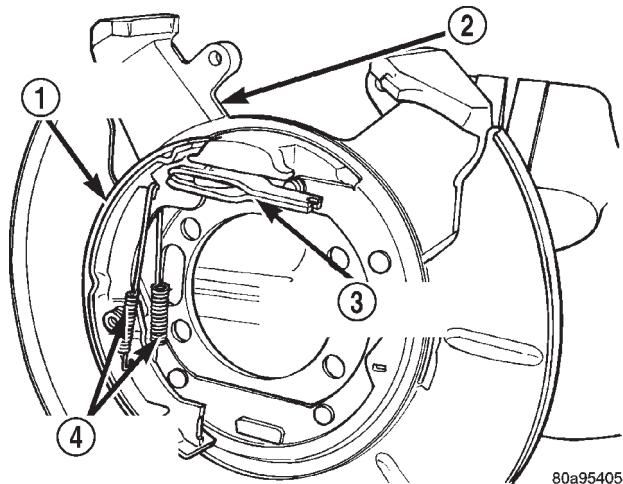


Fig. 156 Upper Return Springs

- 1 - TRAILING PARK BRAKE SHOE
- 2 - ADAPTER
- 3 - PARK BRAKE ACTUATOR
- 4 - UPPER RETURN SPRINGS

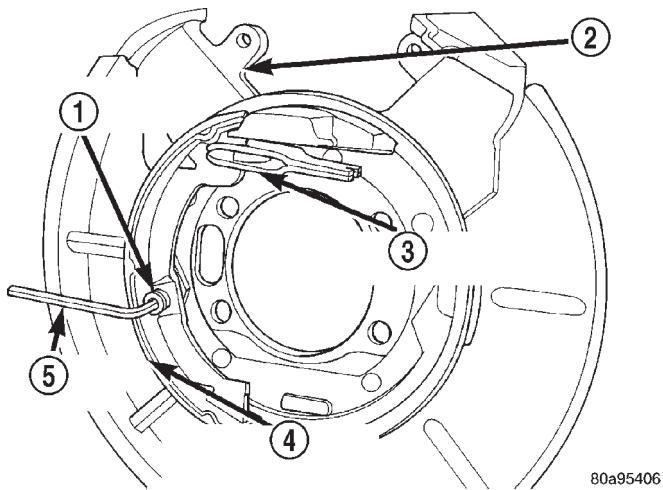


Fig. 157 Trailing Brake Shoe Hold Down Pin And Spring

- 1 - HOLD DOWN SPRING PIN
- 2 - ADAPTER
- 3 - PARK BRAKE ACTUATOR
- 4 - TRAILING PARK BRAKE SHOE
- 5 - ALLEN WRENCH

INSTALLATION

- (1) Install the trailing brake shoe on the adapter.

NOTE: When the hold down pin is installed, the long part of the hold down pin is to be positioned strait up and down. This will ensure that the hold down pin is correctly engaged with the adapter.

- (2) Install the hold down spring and pin (Fig. 157) on the trailing park brake shoe.

- (3) Install the upper return springs (Fig. 156) on the trailing park brake shoe.

(4) Install the upper return springs on the leading park brake shoe (Fig. 155). Then position the top of the leading park brake shoe at the upper anchor and rotate the bottom of the shoe outward until correctly installed on the adapter.

- (5) Install the adjuster (Fig. 154) between the leading and trailing park brake shoe.

NOTE: When the hold down pin is installed, the long part of the hold down pin is to be positioned strait up and down. This will ensure that the hold down pin is correctly engaged with the adapter.

- (6) Install the hold down spring and pin (Fig. 153) on the leading park brake shoe.

(7) Install the lower return spring (Fig. 152) on the leading and trailing park brake shoes. **When installing the hold down spring it is to be installed behind the park brake shoes (Fig. 152).**

- (8) Install the 4 mounting bolts for the adapter and hub/bearing into the bolt holes in the axle.

- (9) Position the adapter on the 4 mounting bolts installed in the rear axle (Fig. 158).

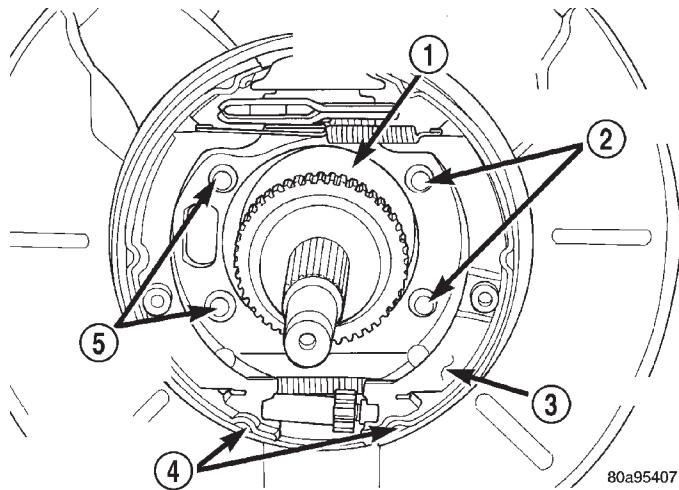


Fig. 158 Adapter Installed On Mounting Bolts

- 1 - DRIVESHAFT OUTER C/V JOINT
- 2 - MOUNTING BOLTS
- 3 - ADAPTER
- 4 - PARK BRAKE SHOES
- 5 - MOUNTING BOLTS

- (10) Install the hub/bearing on the stub shaft of outer C/V joint and into the end of the axle. (Fig. 150).

- (11) In a progressive crisscross pattern, tighten the 4 hub/bearing mounting bolts until the hub/bearing is squarely seated against the axle. Then tighten the

REMOVAL AND INSTALLATION (Continued)

hub/bearing mounting bolts to a torque of 129 N·m (95 ft. lbs.).

(12) Install the wheel speed sensor on the hub/bearing and adapter. Install the wheel speed sensor attaching bolt (Fig. 148). Tighten the wheel speed sensor attaching bolt to a torque of 12 N·m (105 in. lbs.).

(13) Install the park brake cable into its mounting hole in the adapter. **Be sure all the locking tabs on the park brake cable retainer are expanded out to ensure the cable will not pull out of the adapter.**

(14) Install the end of the park brake cable on the park brake actuator lever (Fig. 146).

NOTE: The horseshoe clip must be installed and installed properly when the park brake cable is installed in the adapter. The purpose of the horseshoe clip is to prevent park brake cable retainer from moving in the adapter. If horseshoe clip is not installed the park brake cable retainer will rattle in the adapter.

(15) Install a **NEW** horseshoe clip on the park brake cable retainer (Fig. 146). The horseshoe clip is installed between the retainer for the park brake cable and the adapter. Horseshoe clip must be installed with the curved end of the clip pointing straight up and the edge of the curved end facing toward the rear of the vehicle (Fig. 146).

(16) Remove the locking pliers (Fig. 142) from the front park brake cable.

(17) Adjust the park brake drum-in-hat brake shoes. See Park Brake Shoe Adjustment in the adjustment section in this group of the service manual for the proper park brake shoe adjustment procedure.

(18) Install the rotor on the hub/bearing.

(19) Carefully lower caliper and brake shoes over rotor and onto the adapter using the reverse procedure for removal (Fig. 144).

CAUTION: When installing guide pin bolts extreme caution should be taken not to crossthread the caliper guide pin bolts.

(20) Install the caliper guide pin bolts (Fig. 143). Tighten the guide pin bolts to a torque of 22 N·m (192 in. lbs.).

(21) Clean all foreign material off the threads of the outer C/V joint stub shaft. Install the washer and hub nut (Fig. 141) on the stub shaft of the outer C/V joint.

(22) Set the parking brake.

(23) Tighten the hub nut to a torque of 244 N·m (180 ft. lbs.).

(24) Install the spring washer (Fig. 140) on the stub shaft of the outer C/V joint.

(25) Install the nut retainer and cotter pin (Fig. 139) on the stub shaft of the outer C/V joint.

(26) Install the wheel and tire assembly. Tighten the wheel mounting stud nuts in proper sequence until all nuts are torqued to half specification. Then repeat the tightening sequence to the full specified torque of 135 N·m (100 ft. lbs.).

(27) Lower vehicle.

(28) Fully apply and release the park brake pedal one time. This will seat and correctly adjust the park brake cables.

CAUTION: Before moving vehicle, pump the brake pedal several times to insure the vehicle has a firm brake pedal to adequately stop vehicle.

(29) Road test the vehicle and make several stops to wear off any foreign material on the brakes and to seat the brake shoe linings.

BRAKE LAMP SWITCH

REMOVAL

(1) Remove the trim cover from below the steering column and lower steering column cover. To do this, back out the two plastic retainer screws securing it to the instrument panel.

(2) Remove the brake lamp switch from its bracket (Fig. 159). The brake lamp switch is removed by depressing and holding the brake pedal while rotating brake lamp switch in a counterclockwise direction approximately 30 degrees. Pull the switch rearward and remove it from its mounting bracket.

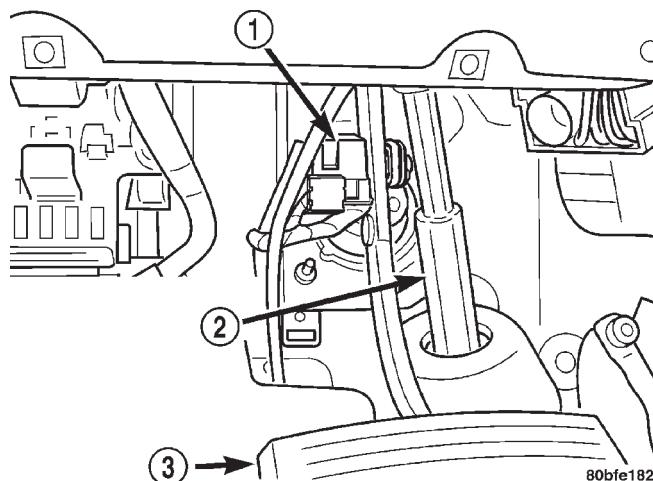


Fig. 159 Brake Lamp Switch

1 – SWITCH

2 – STEERING COLUMN INTERMEDIATE SHAFT

3 – BRAKE PEDAL

REMOVAL AND INSTALLATION (Continued)

(3) Disconnect the wiring harness connector from the switch.

INSTALLATION

NOTE: Prior to installing brake lamp switch into the mounting bracket, the plunger must be moved to its fully extended position using the procedure in Step 1.

(1) Hold the brake lamp switch firmly in one hand. Using the other hand, pull outward on the plunger of the switch until it has ratcheted out to its fully extended position.

(2) Place a small amount of multipurpose grease on the bracket attached to the brake pedal where the brake lamp switch plunger contacts it once installed.

(3) Connect the wiring harness connector to the brake lamp switch.

(4) Install the brake lamp switch in the brake pedal bracket (Fig. 159). Install it using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock the switch into place. It should be aligned straight up and down (Fig. 159).

CAUTION: Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

(5) Gently release/pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(6) Check the brake lamps to verify they are operating properly and not staying on when the pedal is in the released position.

(7) Reinstall the trim cover below the steering column and lower steering column cover.

DISASSEMBLY AND ASSEMBLY

MASTER CYLINDER TO POWER BRAKE BOOSTER VACUUM SEAL

(1) Remove the master cylinder from the power brake vacuum booster. Refer to Master Cylinder removal, for the required procedure to remove master cylinder from power brake vacuum booster.

(2) Using a soft tool such as a trim stick, remove the vacuum seal from the master cylinder mounting flange.

(3) Using Mopar Brake Parts Cleaner or an equivalent, thoroughly clean end of master cylinder housing and master cylinder push rod.

(4) Install new master cylinder to power brake booster vacuum seal on master cylinder. **When installing new vacuum seal, be sure it is squarely seated against master cylinder mounting flange and in groove of push rod (Fig. 160).**

(5) Bleed the master cylinder assembly prior to

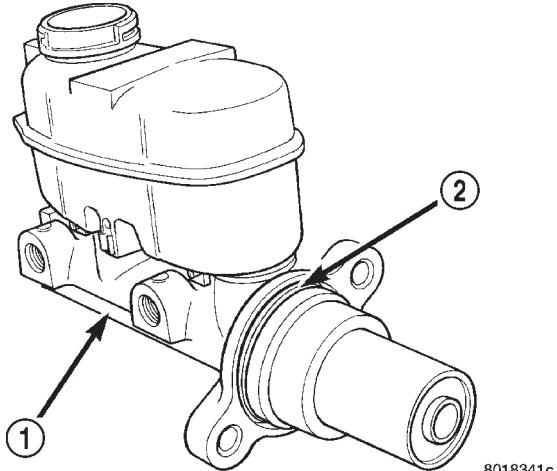


Fig. 160 Vacuum Seal Installed On Master Cylinder

- 1 – MASTER CYLINDER ASSEMBLY
2 – VACUUM SEAL

installing it on the power brake vacuum booster.

(6) Install master cylinder assembly on the power brake vacuum booster. Refer to Master Cylinder Installation for the required procedure to install the master cylinder on the power brake vacuum booster.

(7) Road test vehicle to ensure proper operation of the vehicle's power brake system.

MASTER CYLINDER FLUID RESERVOIR

(1) Clean master cylinder housing and brake fluid reservoir. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent.

(2) Remove the filler tube and brake fluid reservoir cap. Using a syringe or equivalent type tool empty as much brake fluid as possible from the reservoir.

CAUTION: When removing fluid reservoir from the master cylinder, do not pry off using any type of tool. This can damage the fluid reservoir or master cylinder housing.

DISASSEMBLY AND ASSEMBLY (Continued)

(3) Remove the master cylinder assembly from the power brake vacuum booster. Refer to master cylinder, in the removal and installation section in this group of the service manual for the required procedure

(4) Mount the master cylinder in a vise using the master cylinder mounting flange (Fig. 161).

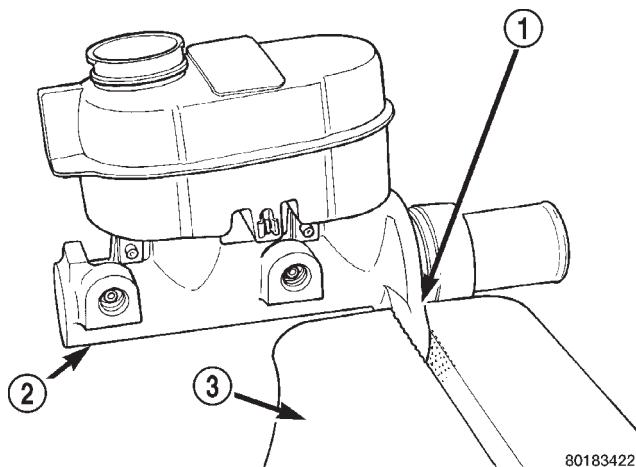


Fig. 161 Master Cylinder Correctly Mounted In Vise

- 1 – MASTER CYLINDER MOUNTING FLANGE
- 2 – MASTER CYLINDER ASSEMBLY
- 3 – VISE

(5) Using correct size pin punch, remove the 2 retaining pins between the fluid reservoir and master cylinder housing (Fig. 162). Rock the brake fluid reservoir from side to side while pulling up to remove it from the seal grommets in master cylinder housing.

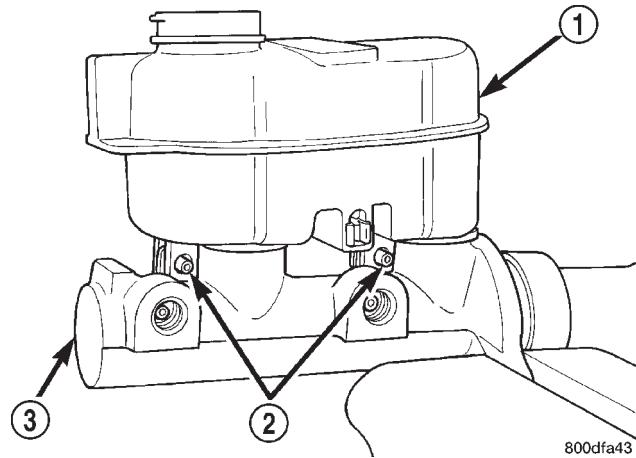


Fig. 162 Fluid Reservoir Retaining Pins

- 1 – FLUID RESERVOIR
- 2 – RETAINING PINS
- 3 – MASTER CYLINDER

(6) Remove the 2 master cylinder housing to brake fluid reservoir seal grommets (Fig. 163).

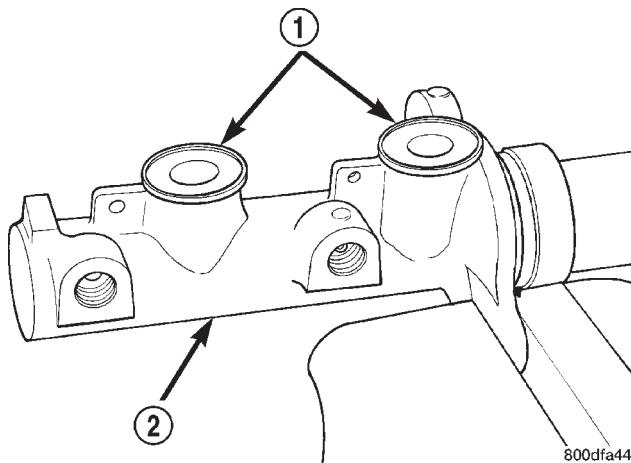


Fig. 163 Master Cylinder To Fluid Reservoir Seal Grommets

- 1 – SEAL GROMMETS
- 2 – MASTER CYLINDER

(7) Install new master cylinder housing to brake fluid reservoir sealing grommets (Fig. 163) in master cylinder housing.

(8) Lubricate reservoir mounting area with fresh clean brake fluid. Place reservoir in position over sealing grommets. Seat reservoir into sealing grommets using a rocking motion while firmly pressing down on fluid reservoir.

(9) Be sure fluid reservoir is positioned properly on master cylinder. **Bottom of fluid reservoir is to be touching the top of both sealing grommets when properly installed on master cylinder housing.**

(10) Install the 2 fluid reservoir to master cylinder retaining pins (Fig. 162).

(11) Install the master cylinder assembly on the power brake vacuum booster. Refer to master cylinder, in the removal and installation section in this group of the service manual for the required procedure

(12) Install filler tube on the fluid reservoir. Fill fluid reservoir to its proper level as indicated on the outboard side of the fluid reservoir. **Be careful not to over fill the fluid reservoir, fluid is not intended to be stored in the filler tube. Install cap on fluid reservoir filler tube.**

MASTER CYLINDER FLUID RESERVOIR FILL TUBE

The master cylinder fluid reservoir filler neck is removable from the master cylinder fluid reservoir. The filler neck if required, can be replaced as a separate component of the fluid reservoir.

The filler neck is removed and installed using the following procedure.

DISASSEMBLY AND ASSEMBLY (Continued)

REMOVE

(1) Check brake fluid level in master cylinder fluid reservoir to be sure brake fluid is not in the filler neck. If brake fluid is in filler neck, lower fluid level before removing filler neck from fluid reservoir

(2) Grasp filler neck at cap end (Fig. 164) and push straight down. This will cause the filler neck to pop out of the fluid reservoir.

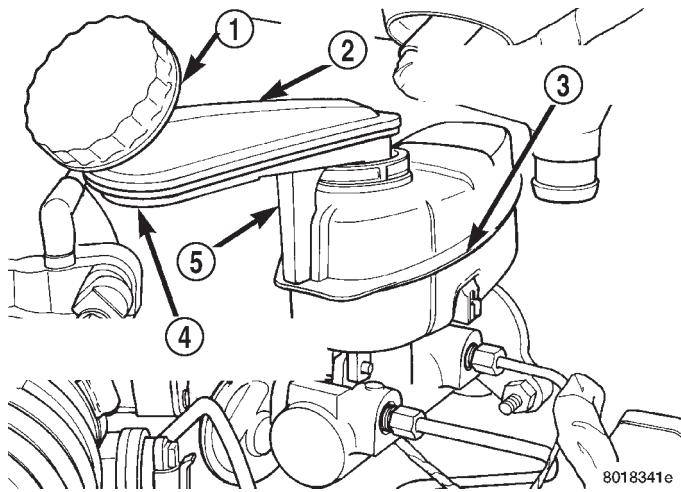


Fig. 164 Master Cylinder Fluid Reservoir Filler Neck

- 1 - CAP
- 2 - FILLER NECK
- 3 - MASTER CYLINDER FLUID RESERVOIR
- 4 - PUSH STRAIGHT DOWN ON FILLER NECK HERE
- 5 - TAB

INSTALL

(1) Wet the O-ring on the reservoir end of the filler neck with fresh clean brake fluid.

(2) Position the filler neck in the opening on the fluid reservoir. Ensure tab on filler neck (Fig. 164) is in the groove on the front of the fluid reservoir.

(3) Push down while slightly rocking filler neck until filler neck snaps into the fluid reservoir opening.

(4) Install cap on filler neck.

(5) Check and/or add brake fluid in reservoir to ensure it is at the correct level.

DISC BRAKE CALIPER (FRONT AND REAR)

CLEANING AND INSPECTION

Check for brake fluid leaks in and around dust boot area and inboard brake pad, and for any ruptures, brittleness or damage to the piston dust boot. If the dust boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new piston seal and dust boot, and piston if scored. Refer to Caliper Disassembly And Re-Assembly Procedures in

Disc Brake Caliper Service in this section of the service manual.

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Guide Pin Bushing Service in Disc Brake Caliper Service in this section of the service manual.

CALIPER GUIDE PIN BUSHING SERVICE

The double pin caliper uses a sealed for life bushing and sleeve assembly. If required this assembly can be serviced using the following procedure.

REMOVING CALIPER GUIDE PIN BUSHINGS

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang caliper assembly on a wire hook away from the brake rotor.

(2) Push out and then pull the steel sleeve from the inside of the bushing using your fingers as shown in (Fig. 165).

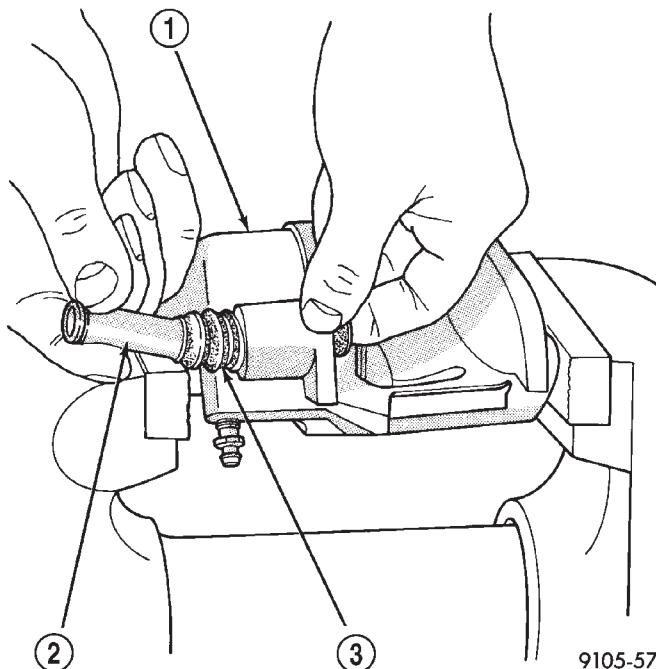
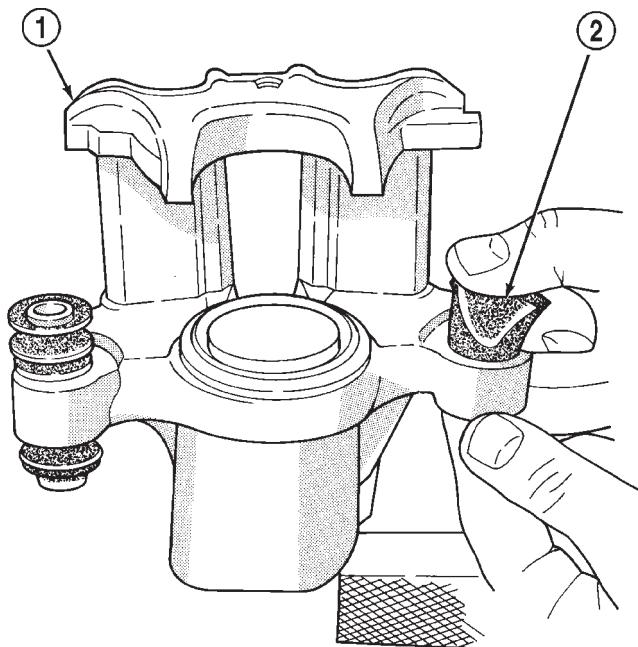


Fig. 165 Removing Inner Sleeve From Bushing

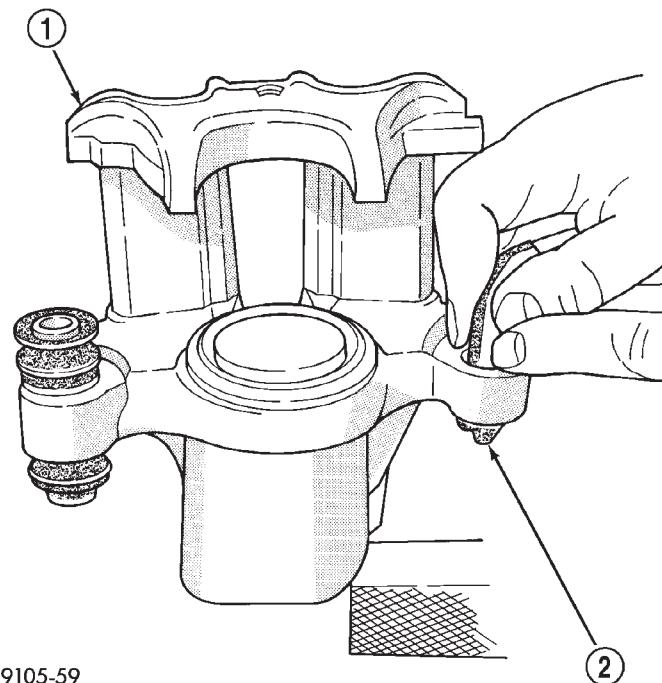
- 1 - CALIPER
- 2 - SLEEVE
- 3 - BUSHING

(3) Using your fingers, collapse one side of the bushing. Then pull on the opposite side to remove the bushing from the brake caliper housing (Fig. 166).

DISASSEMBLY AND ASSEMBLY (Continued)



9105-58



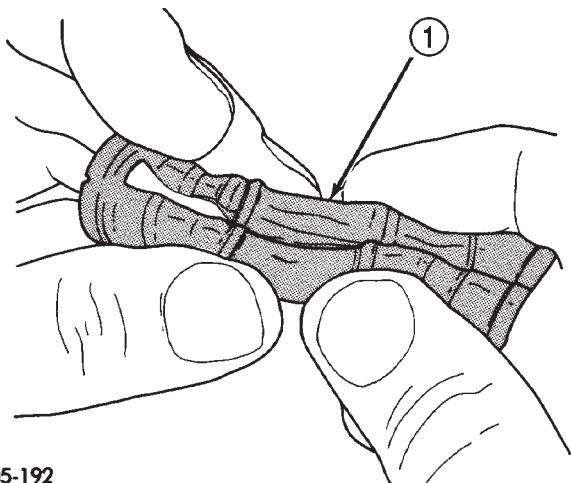
9105-59

Fig. 166 Removing Bushing From Caliper

- 1 – CALIPER
2 – BUSHING

INSTALLING CALIPER GUIDE PIN BUSHINGS

(1) Fold the bushing in half lengthwise at the solid middle section of the bushing (Fig. 167).



9205-192

Fig. 167 Folded Caliper Guide Pin Bushing

- 1 – CALIPER GUIDE PIN BUSHING

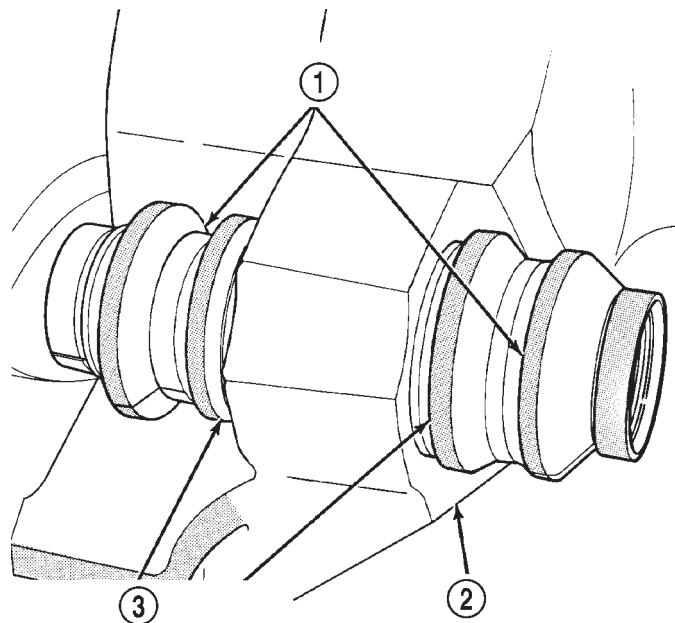
(2) Insert the folded bushing into the caliper housing (Fig. 168). **Do not use a sharp object to perform this step due to possible damage to the bushing.**

(3) Unfold the bushing using your fingers or a wooden dowel until the bushing is fully seated into

Fig. 168 Installing Caliper Guide Pin Bushing

- 1 – CALIPER
2 – BUSHING

the caliper housing. Flanges should be seated evenly on both sides of the bushing hole (Fig. 169).



9205-193

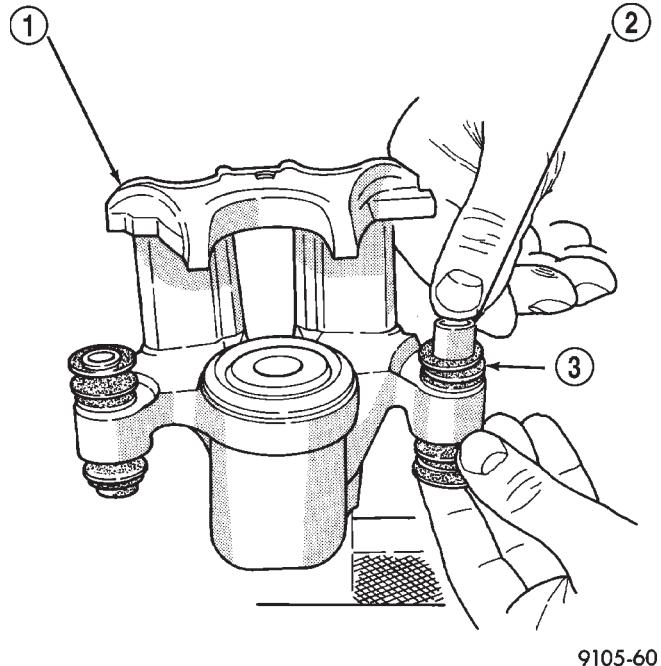
Fig. 169 Bushing Correctly Installed In Caliper

- 1 – BUSHING
2 – CALIPER
3 – BE SURE BOTH BUSHING FLANGES ARE FULLY SEATED AROUND CALIPER BUSHING BORES.

DISASSEMBLY AND ASSEMBLY (Continued)

(4) Lubricate the inside surfaces of the bushing using Mopar, Silicone Dielectric Compound or an equivalent.

(5) Install guide pin sleeve into one end of bushing until seal area of bushing is past seal groove in sleeve (Fig. 170).



9105-60

Fig. 170 Installing Sleeve In Bushing

- 1 - CALIPER
- 2 - SLEEVE
- 3 - BUSHING

(6) Holding convoluted boot end of bushing with one hand, push steel sleeve/bushing through boot until one end of bushing is fully seated into seal groove on one end of sleeve (Fig. 170).

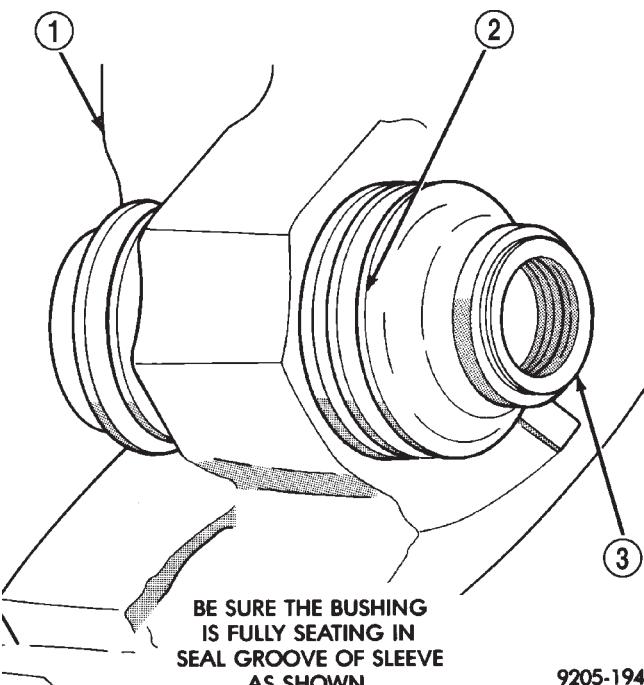
(7) Holding sleeve in place, work other end of bushing over end of sleeve and into the seal groove on sleeve (Fig. 171). Be sure other end of bushing did not come out of seal groove in sleeve.

(8) When the sleeve is seated properly into the bushing, the sealed for life sleeve/bushing can be held between your fingers and easily slid back and forth without the bushing unseating from the sleeve groove.

CALIPER DISASSEMBLY

WARNING: UNDER NO CONDITION SHOULD AIR PRESSURE EVER BE USED TO REMOVE A PISTON FROM A CALIPER BORE. PERSONAL INJURY COULD RESULT FROM SUCH A PRACTICE.

(1) Remove caliper from brake rotor (See Brake Shoe Removal). Hang assembly on a wire hook away



9205-194

Fig. 171 Correctly Installed Caliper Sleeve And Bushing

- 1 - CALIPER
- 2 - BUSHING
- 3 - SLEEVE

from rotor, so hydraulic fluid cannot get on rotor. Place a small piece of wood between the piston and caliper fingers.

(2) Carefully depress brake pedal to hydraulically push piston out of bore. Then apply and hold down the brake pedal to any position beyond the first inch of pedal travel. This will prevent loss of brake fluid from the master cylinder.

(3) If both front caliper pistons are to be removed, disconnect brake tube at flexible brake hose at frame rail. Plug brake tube and remove piston from opposite caliper using the same process as above for the first piston removal.

(4) Disconnect the brake fluid flex hose from the caliper assembly.

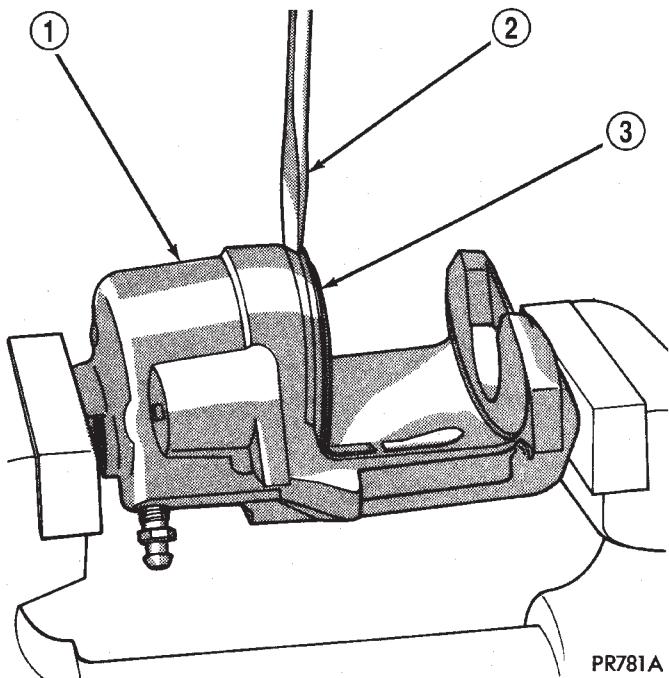
CAUTION: Do not use excessive force when clamping caliper in vise. Excessive vise pressure will cause bore distortion and binding of piston.

(5) To disassemble caliper, mount in a vise equipped with protective jaws.

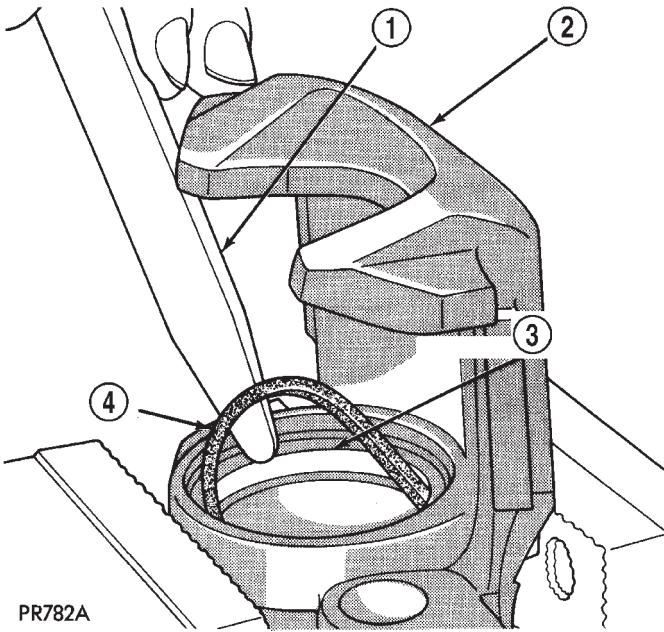
(6) Remove guide pin sleeves and guide pin bushings. See Removing Guide Pin Bushings in the caliper disassembly section of this manual.

(7) Remove the piston dust boot from the caliper and discard (Fig. 172).

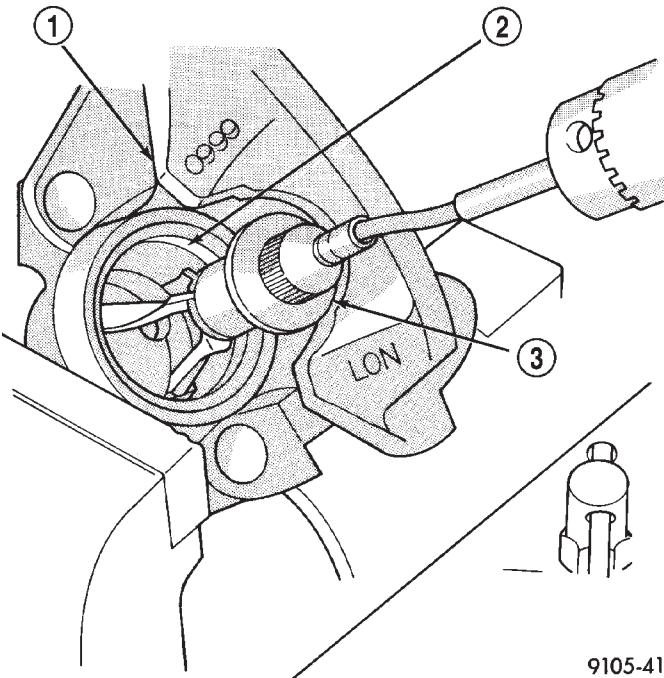
DISASSEMBLY AND ASSEMBLY (Continued)

**Fig. 172 Removing Caliper/Piston Dust Boot**

- 1 - CALIPER
2 - SCREWDRIVER
3 - BOOT

**Fig. 173 Removing Piston Seal From Caliper**

- 1 - PLASTIC TRIM STICK
2 - CALIPER
3 - PISTON SEAL GROOVE
4 - PISTON SEAL

**Fig. 174 Honing Brake Caliper Piston Bore**

- 1 - CALIPER
2 - CALIPER BORE
3 - SPECIAL TOOL C-4095

NOTE: When using Caliper Honing Tool, Special Tool C-4095, coat the stones and bore with brake fluid. After honing the bore, carefully clean the seal and boot grooves with a stiff non-metallic rotary brush.

DISASSEMBLY AND ASSEMBLY (Continued)

NOTE: Use extreme care in cleaning the caliper after honing. Remove all dirt and grit by flushing the caliper with brake fluid; wipe dry with a clean, lint free cloth and then clean a second time.

CAUTION: When inspecting caliper piston, do not use anything but solvents to clean piston surface. If surface of piston cannot be cleaned using only solvents, piston must be replaced.

(12) Inspect caliper piston for pitting, scratches, or any physical damage. Replace piston if there is evidence of scratches, pitting or physical damage.

CALIPER ASSEMBLY

CAUTION: Excessive vise pressure will cause bore distortion and binding of piston.

(1) Clamp caliper in a vise (with protective caps installed on jaws of vise).

(2) Dip new piston seal in clean brake fluid and install in the groove of the caliper bore. Seal should be positioned at one area in groove and gently worked around the groove (Fig. 175), using only your fingers until properly seated. **NEVER USE AN OLD PISTON SEAL.** Be sure that fingers are clean and seal is not twisted or rolled (Fig. 175).

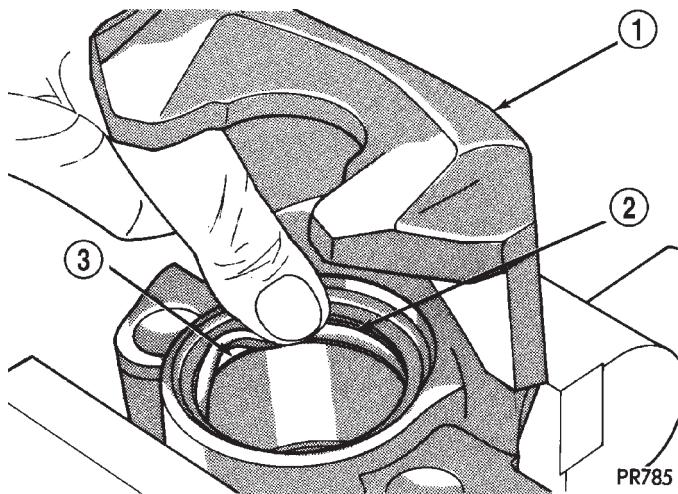


Fig. 175 Installing New Piston Seal In Caliper

- 1 - CALIPER
- 2 - PISTON SEAL
- 3 - SEAL GROOVE

(3) Coat new piston boot with clean brake fluid leaving a generous amount inside boot.

(4) Position dust boot over piston after coating with brake fluid.

CAUTION: Force must be applied to the piston uniformly to avoid cocking and binding of the piston in the bore of the caliper.

(5) Install piston into caliper bore pushing it past the piston seal until it bottoms in the caliper bore (Fig. 176).

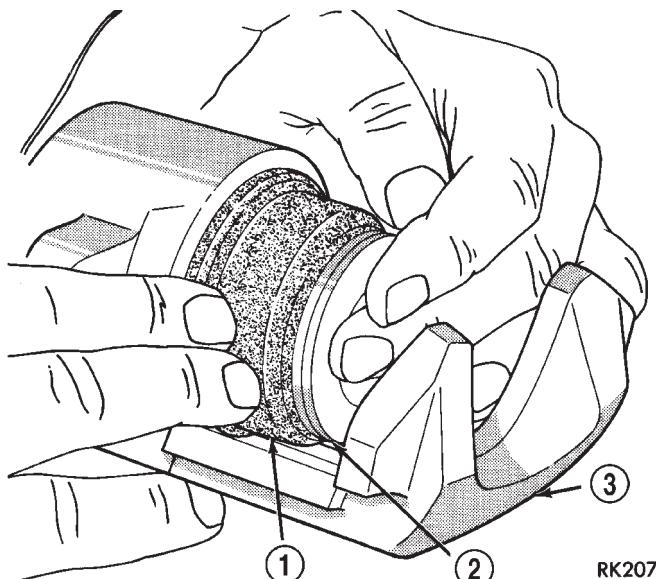


Fig. 176 Installing Piston Into Caliper Bore

- 1 - BOOT
- 2 - PISTON
- 3 - CALIPER

(6) Position dust boot into the counterbore of the caliper assembly piston bore.

(7) Using a hammer and Installer Piston Caliper Boot, Special Tool C-4689 and Handle, Special Tool C-4171, drive boot into counterbore of the caliper (Fig. 177).

(8) Install guide pin sleeves and bushings. See Install Guide Pin Bushings section in the caliper disassembly section of this manual.

(9) Install brake pads. See Installing Brake Pads in the Brake Pad Service Procedures section of this manual.

(10) Before installing caliper assembly on vehicle, inspect brake rotor. If any conditions as described in Checking Brake Rotor for Runout and Thickness are present the rotor, must be replaced or refaced. If the rotor does not require any servicing, install caliper assembly.

(11) Install brake hose onto caliper using banjo bolt. Torque the brake hose to caliper assembly banjo bolt to 33 N·m (24 ft. lbs.). **New seal washers MUST always be used when installing brake hose to caliper.**

(12) Bleed the brake system (see Bleeding Brake System).

DISASSEMBLY AND ASSEMBLY (Continued)

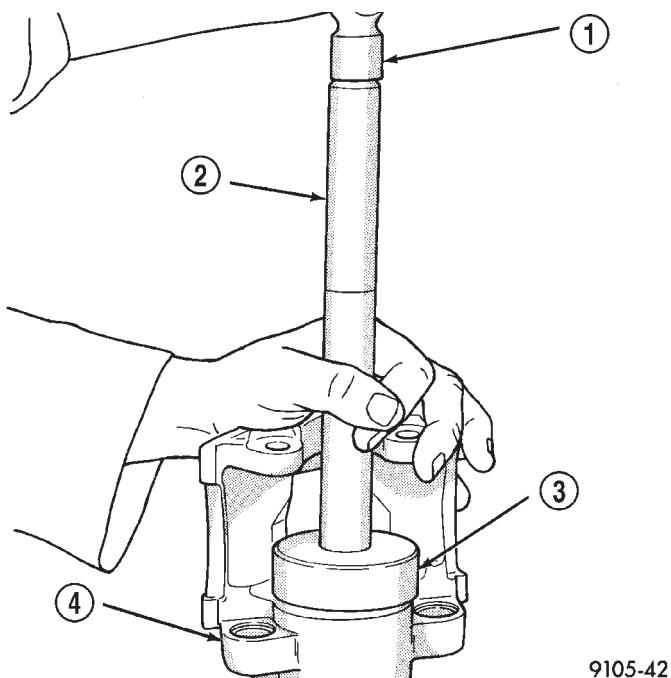


Fig. 177 Installing Dust Boot In Caliper Counterbore

- 1 - HAMMER
- 2 - SPECIAL TOOL C-4171
- 3 - SPECIAL TOOL C-4689
- 4 - CALIPER

DRUM BRAKE WHEEL CYLINDER (REAR)

DISASSEMBLE

To disassemble the wheel cylinders, proceed as follows:

(1) Pry boots away from cylinders and remove (Fig. 178).

(2) Press in on one piston to force out opposite piston, cup and spring (Fig. 178). Then using a soft tool such as a dowel rod, press out the cup and piston that remain in the wheel cylinder.

(3) Wash wheel cylinder, pistons, and spring (Fig. 178) in clean brake fluid or alcohol; **(DO NOT USE ANY PETROLEUM BASE SOLVENTS)** clean thoroughly and blow dry with compressed air. Inspect cylinder bore and piston for scoring and pitting. (Do not use a rag as lint from the rag will stick to bore surfaces.)

(4) Wheel cylinder bores and pistons that are badly scored or pitted should be replaced. Cylinder walls that have light scratches, or show signs of corrosion, can usually be cleaned with crocus cloth, using a circular motion. Black stains on the cylinder walls are caused by piston cups and will not impair operation of cylinder.

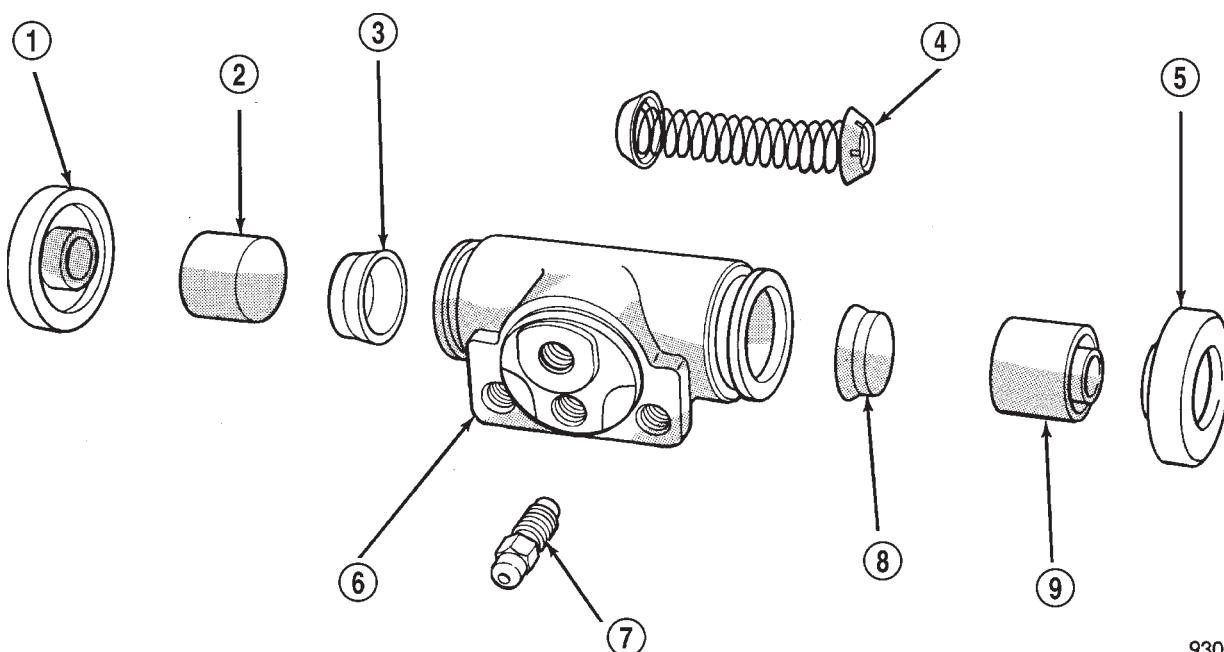


Fig. 178 Rear Wheel Cylinder (Exploded View)

- 1 - PUSH-ON BOOT
- 2 - PISTON
- 3 - CUP
- 4 - CUP EXPANDERS AND SPRING
- 5 - PUSH-ON BOOT
- 6 - CYLINDER
- 7 - BLEEDER SCREW
- 8 - CUP
- 9 - PISTON

DISASSEMBLY AND ASSEMBLY (Continued)

ASSEMBLE

Before assembling the pistons and new cups in the wheel cylinders, dip them in clean brake fluid. If the boots are deteriorated, cracked or do not fit tightly on the pistons or the cylinder casting, install new boots.

- (1) Coat cylinder bore with clean brake fluid.
- (2) Lightly coat the sealing lip and outer surfaces of the wheel cylinder cups with only Mopar Protect-A-Cup Lubricant.
- (3) Install expansion spring with cup expanders in cylinder. Install cups in each end of cylinder with open end of cups facing each other (Fig. 178).
- (4) Install piston in each end of cylinder having the flat face of each piston contacting the flat face of each cup, already installed (Fig. 178).
- (5) Install a boot over each end of cylinder (Fig. 178). **Be careful not to damage boot during installation.**

CLEANING AND INSPECTION

BRAKE TUBES AND HOSES

Flexible rubber hose is used at both front brakes and at the rear axle. Inspection of brake hoses should be performed whenever the brake system is serviced and every 7,500 miles or 12 months, whichever comes first (every engine oil change). Inspect hydraulic brake hoses for surface cracking, scuffing, or worn spots. If the fabric casing of the rubber hose becomes exposed due to cracks or abrasions in the rubber hose cover, the hose should be replaced immediately. Eventual deterioration of the hose can take place with possible burst failure. Faulty installation can cause twisting, resulting in wheel, tire, or chassis interference.

The steel brake tubing should be inspected periodically for evidence of physical damage or contact with moving or hot components.

The flexible brake tube sections used on this vehicle in the primary and secondary tubes from the master cylinder to the ABS hydraulic control unit connections, and the chassis brake tubes between the hydraulic control unit and the proportioning valve must also be inspected. This flexible tubing must be inspected for kinks, fraying and its contact with other components of the vehicle or contact with the body of the vehicle.

DISC BRAKES (FRONT)

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the shoe and lining assemblies. (See Brake Shoe Removal).

Combined shoe and lining thickness should be measured at the thinnest part of the brake shoe assembly.

When a shoe and lining assembly is worn to a thickness of approximately 7.95 mm (0.313 inch) it should be replaced.

Replace **both** shoe assemblies (inboard and outboard) on the front wheels. It is also necessary that **both** front wheel brake shoe assembly sets be replaced, whenever shoe assemblies on either side of the vehicle require replacement.

If a shoe assembly does not require replacement, reinstall it, making sure each shoe assembly is returned to its original position. (See Brake Shoe Installation).

DISC BRAKES (REAR)

BRAKE SHOE (PAD) LINING WEAR

If a visual inspection does not adequately determine the condition of the lining, a physical check will be necessary. To check the amount of lining wear, remove the wheel and tire assemblies, and the calipers.

Remove the rear disc brake shoes. Refer to Disc Brake Shoes in the Removal And Installation section in this group of the service manual for the required procedure.

The combined brake shoe and lining material thickness should be measured at the thinnest part of the assembly.

When a set of brake shoes are worn to a total thickness of approximately 7.0 mm (9/32 inch) they should be replaced.

Replace **both** brake shoe assemblies (inboard and outboard). It is necessary that **both** rear wheel sets be replaced whenever brake shoe assemblies on either side are replaced.

If the brake shoe assemblies do not require replacement, reinstall, the assemblies making sure each brake shoe is returned to the original position. Refer to Rear Disc Brake Shoe Installation in the Removal And Installation section in this group of the service manual for the required procedure.

CALIPER INSPECTION

Check for brake fluid leaks in and around boot area and inboard lining, and for any ruptures, brittleness or damage to the piston dust boot. If the boot is damaged, or a fluid leak is visible, disassemble caliper assembly and install a new seal and boot, and piston if scored. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

CLEANING AND INSPECTION (Continued)

Check the guide pin dust boots to determine if they are in good condition. Replace if they are damaged, dry, or found to be brittle. Refer to Rear Disc Brake Caliper in the Disassembly And Assembly Section in this group of the service manual.

DRUM BRAKES (REAR)

REAR DRUM BRAKE SHOE LINING

(1) Remove the tire and wheel assembly from the vehicle

(2) Remove the rear brake adjusting hole cover plug (Fig. 179).

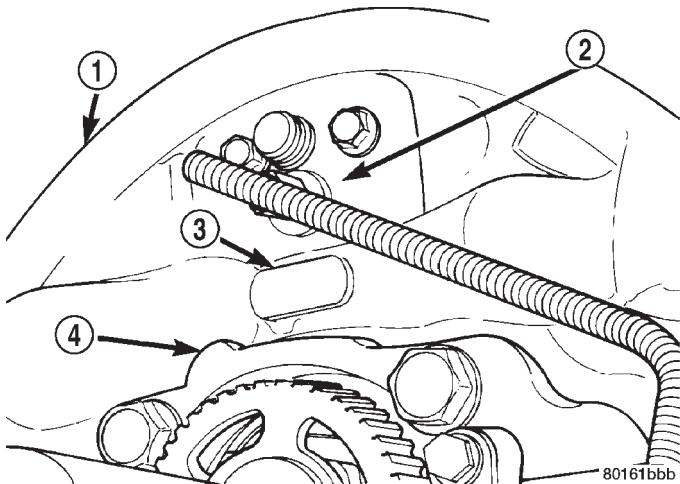


Fig. 179 Brake Adjustment Hole Rubber Plug

1 – REAR BRAKE SUPPORT PLATE

2 – REAR WHEEL CYLINDER

3 – ADJUSTMENT HOLE PLUG

4 – REAR AXLE

(3) Insert a thin screwdriver into brake adjusting hole to hold the adjusting lever away from the notches on the adjusting screw star wheel.

(4) Insert Tool C-3784 into brake adjusting hole and engage notches of brake adjusting screw star wheel. Release brake by prying down with adjusting tool.

(5) Remove the rear brake drum from the rear hub/bearing assembly.

(6) Inspect brake lining for wear, shoe alignment, and or contamination from grease or brake fluid.

REAR DRUM BRAKE WHEEL CYLINDER

With brake drums removed, inspect the wheel cylinder boots for evidence of a brake fluid leak. Visually check the boots for cuts, tears, or heat cracks. If any of these conditions exist, the wheel cylinders should be completely cleaned, inspected and new parts installed.

If a wheel cylinder is leaking and the brake lining material is saturated with brake fluid, the brake shoes must be replaced.

ADJUSTMENTS

DRUM BRAKE SHOE ADJUSTMENT (REAR)

NOTE: Normally, self-adjusting drum brakes will not require manual brake shoe adjustment. Although, in the event of a brake shoe replacement, it is advisable to make the initial adjustment manually to speed up the adjusting time.

NOTE: Before raising the vehicle, verify the parking brake lever is fully released.

(1) Raise the vehicle. See Hoisting in the Lubrication And Maintenance section.

(2) Remove rubber plug from rear brake adjusting hole in the rear brake support plate (Fig. 180).

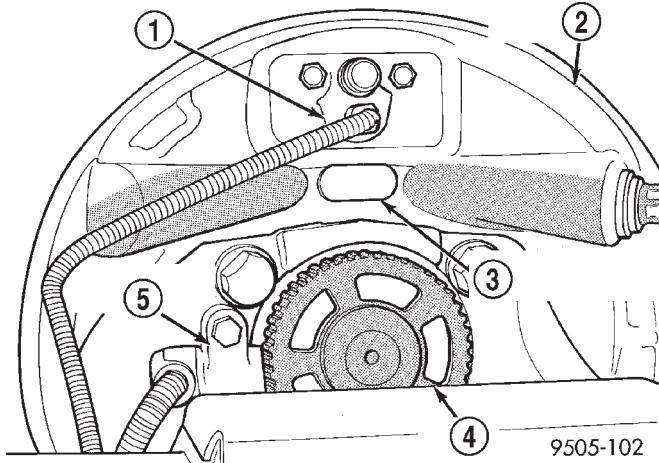


Fig. 180 Brake Adjusting Hole Plug

1 – REAR BRAKE WHEEL CYLINDER

2 – REAR BRAKE SUPPORT PLATE

3 – BRAKE ADJUSTING HOLE PLUG

4 – TONE WHEEL

5 – WHEEL SPEED SENSOR

(3) Insert a thin screwdriver through the adjusting hole in the support plate and against the star wheel of the adjusting screw. Move handle of the tool upward rotating the star wheel until a slight drag is felt when tire and wheel assembly is rotated.

(4) Insert a second thin screwdriver or piece of welding rod into brake adjusting hole and push the adjusting lever out of engagement with the star wheel. **Care should be taken so as not to bend adjusting lever or distort lever spring.**

ADJUSTMENTS (Continued)

(5) While holding the adjusting lever out of engagement, back off the star wheel just enough to ensure a free wheel with no brake shoe drag.

(6) Repeat the above adjustment at the other rear wheel.

(7) Install the adjusting hole rubber plugs back in the rear brake support plates (Fig. 180).

(8) Lower the vehicle.

PARKING BRAKE SHOES (WITH REAR DISC BRAKES)

CAUTION: Before adjusting the park brake shoes be sure that the park brake pedal is in the fully released position. If park brake pedal is not in the fully released position, the park brake shoes can not be accurately adjusted.

(1) Raise vehicle.

(2) Remove tire and wheel.

(3) Remove disc brake caliper from caliper adapter (Fig. 181). If required, refer to Rear Disc Brake Caliper in the Removal And Installation Section in this group of the service manual for the removal procedure.

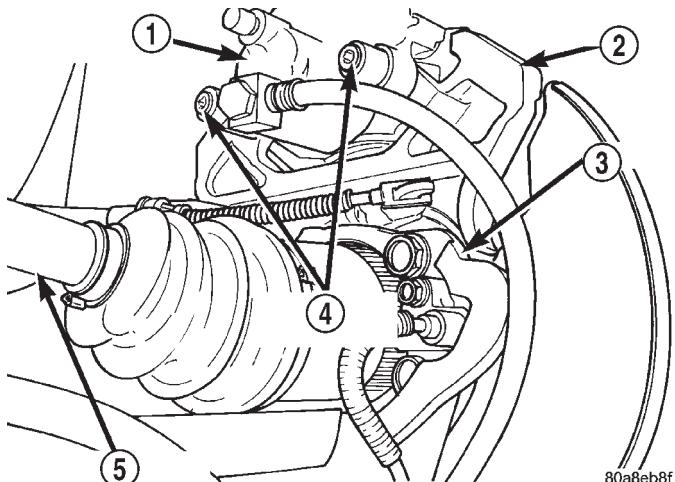


Fig. 181 Disc Brake Caliper

1 - DISC BRAKE CALIPER

2 - ADAPTER

3 - AXLE

4 - GUIDE PIN BOLTS

5 - DRIVESHAFT

(4) Remove rotor from hub/bearing.

NOTE: When measuring the brake drum diameter, the diameter should be measured in the center of the area in which the park brake shoes contact the surface of the brake drum.

(5) Using Gauge, Brake Shoe, Special Tool C-3919 or an equivalent, **accurately** measure the inside diameter of the park brake drum portion of the rotor (Fig. 182).

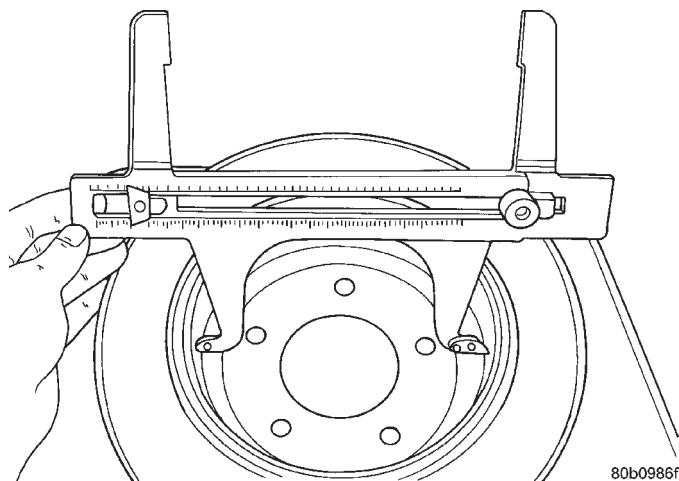


Fig. 182 Measuring Park Brake Drum Diameter

(6) Using a ruler that reads in 64th of an inch, accurately read the measurement of the inside diameter of the park brake drum from the special tool (Fig. 183).

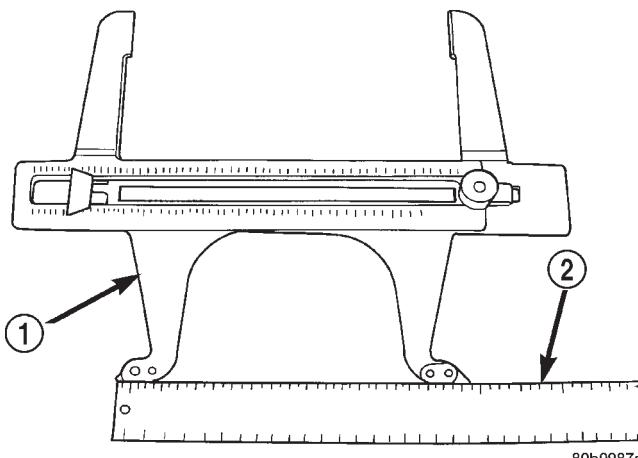


Fig. 183 Reading Park Brake Drum Diameter

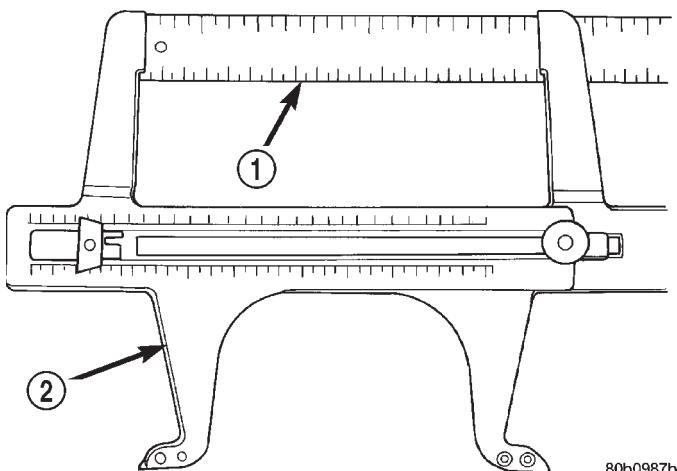
1 - SPECIAL TOOL C-3919

2 - RULER

(7) Reduce the inside diameter measurement of the brake drum that was taken using Special Tool C-3919 by 1/64 of an inch. Reset Gauge, Brake Shoe, Special Tool C-3919 or the equivalent used, so that the outside measurement jaws are set to the reduced measurement (Fig. 184).

(8) Place Gauge, Brake Shoe, Special Tool C-3919, or equivalent over the park brake shoes. The special tool must be located diagonally across at the top of one shoe and bottom of opposite shoe (widest point) of the park brake shoes.

ADJUSTMENTS (Continued)



80b0987b

Fig. 184 Setting Gauge To Park Brake Shoe Measurement

- 1 - RULER
2 - SPECIAL TOOL C-3919

(9) Using the star wheel adjuster, adjust the park brake shoes until the lining on the park brake shoes just touches the jaws on the special tool.

(10) Repeat step 8 above and measure shoes in both directions.

(11) Install brake rotor on hub and bearing.

(12) Rotate rotor to verify that the park brake shoes are not dragging on the brake drum. If park brake shoes are dragging, remove rotor and back off star wheel adjuster one notch and recheck for brake shoe drag against drum. Continue with the previous step until brake shoes are not dragging on brake drum.

(13) Install disc brake caliper on caliper adapter (Fig. 181). If required, refer to Rear Disc Brake Caliper in the Removal And Installation Section in this group of the service manual for the installation procedure.

(14) Install wheel and tire.

(15) Tighten the wheel mounting nuts in the proper sequence until all nuts are torqued to half the specified torque. Then repeat the tightening sequence to the full specified torque of 129 N·m (95 ft. lbs.).

(16) Lower vehicle.

(17) Apply and release the park brake pedal one time. This will seat and correctly adjust the park brake cables.

CAUTION: Before moving vehicle, pump brake pedal several times to ensure the vehicle has a firm enough pedal to stop the vehicle.

(18) Road test the vehicle to ensure proper function of the vehicle's brake system.

PARKING BRAKE CABLE

The park brake cables on this vehicle have an automatic self adjuster built into the park brake pedal mechanism. When the foot operated park brake pedal is in its released (upward most) position, a clock spring automatically adjusts the park brake cables. The park brake cables are adjusted (tensioned) just enough to remove all the slack from the cables. The automatic adjuster system will not over adjust the cables causing rear brake drag.

Due to the automatic adjust feature of the park brake pedal, adjustment of the parking brake cables on these vehicles relies on proper drum brake and park brake shoe adjustment. See Rear Brake Adjustment and Park Brake Shoe Adjustment in the Service Adjustments Section in this group of the service manual.

When the park brake pedal is applied the self adjuster is by-passed and the pedal operates normally to engage the park brakes.

When a service procedure needs to be performed on the park brake pedal or the park brake cables, the automatic self adjuster can be manually locked out by the service technician.

PROPORTIONING VALVE (HEIGHT SENSING)

Proportioning valve actuator adjustment will be required if there is a complaint of premature rear wheel lockup and the front and rear brake shoe linings checked OK during inspection, the height sensing proportioning valve required replacement, or there is a complaint of excessive pedal effort and the vacuum booster and brake pedal checked OK. Make sure the proportioning valve and the mounting bracket are firmly attached to the vehicle. Then, proceed with the following procedure to perform the adjustment of the actuator.

(1) Raise vehicle. Vehicle is to be raised and supported on jackstands or with a frame contact type hoist so the rear suspension of the vehicle is hanging free. See hoisting in the Lubrication And Maintenance section of this service manual.

(2) Remove rear wheels/tires.

(3) Using an appropriate jack, support the rear axle prior to the removal of the track bar and shock absorber bolts from the rear axle.

(4) Unbolt the track bar from the rear axle.

(5) Unbolt both shock absorbers from the rear axle.

(6) Loosen (do not remove) both of the leaf spring to front spring hanger pivot bolts.

ADJUSTMENTS (Continued)

NOTE: When lowering the rear axle be sure that the leaf springs do not come in contact with the hoist limiting the downward movement of the axle. If this occurs an improper adjustment of the actuator may result.

(7) Lower the rear axle so it is at its farthest point of downward movement.

(8) Loosen the adjustment nut (Fig. 185) on the actuator.

(9) Be sure the hooked end of the actuator is correctly (fully) seated in the clip on the proportioning valve lever and that the clip is correctly positioned on the lever of the proportioning valve.

(10) Pull the housing of the proportioning valve actuator toward the spring hanger (Fig. 185) until the lever on the proportioning valve bottoms on the body of the proportioning valve. **Hold the proportioning valve actuator in this position while tightening the adjustment nut (Fig. 185) to a torque of 5 N·m (45 in. lbs.). Proportioning valve adjustment is now complete.**

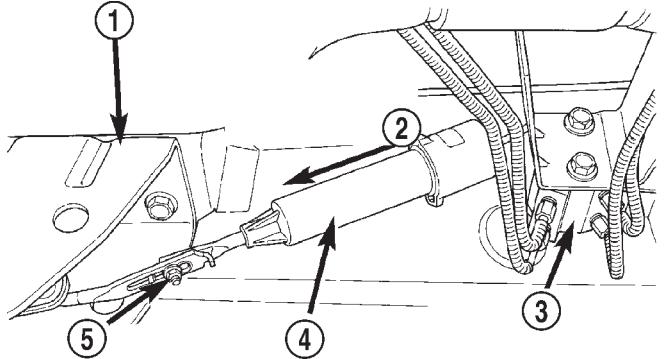


Fig. 185 Proportioning Valve Actuator Adjustment

- 1 – SPRING HANGER
- 2 – PULL ACTUATOR HOUSING IN THIS DIRECTION
- 3 – HEIGHT SENSING PROPORTIONING VALVE
- 4 – PROPORTIONING VALVE ACTUATOR
- 5 – ADJUSTMENT NUT

(11) Install shock absorbers and track bar on rear axle. **Do not tighten the mounting bolts for any of the loosened suspension components at this time.**

(12) Install the wheel/tires.

(13) Lower the vehicle to the ground. **Be sure that the suspension is supporting the full weight of the vehicle.**

(14) Tighten the spring to front hanger pivot bolts to a torque of 156 N·m (115 ft. lbs.).

(15) Tighten the shock absorber mounting bolts to a torque of 101 N·m (75 ft. lbs.).

(16) Tighten the track bar mounting bolt to a torque of 95 N·m (70 ft. lbs.).

(17) Road test vehicle to ensure that the premature rear wheel lockup condition has been corrected.

BRAKE LAMP SWITCH

(1) Remove the trim cover from below the steering column and lower steering column cover. To do this, back out the two plastic retainer screws securing it to the instrument panel.

(2) Remove the brake lamp switch from its bracket (Fig. 186). The brake lamp switch is removed by depressing and holding the brake pedal while rotating brake lamp switch in a counterclockwise direction approximately 30 degrees. Pull the switch rearward and remove it from its mounting bracket.

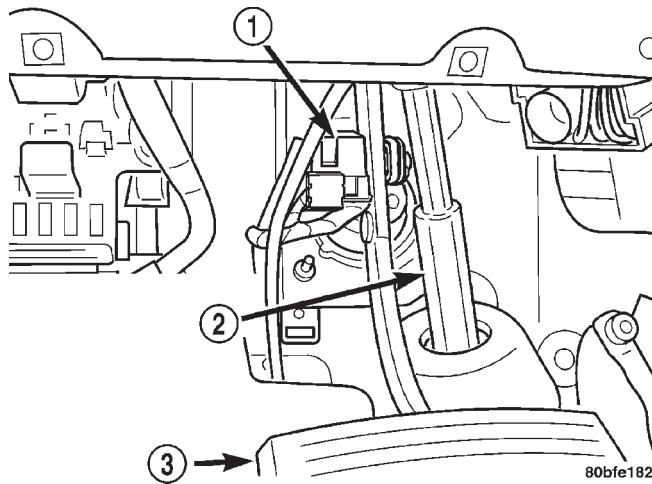


Fig. 186 Brake Lamp Switch

- 1 – SWITCH
- 2 – STEERING COLUMN INTERMEDIATE SHAFT
- 3 – BRAKE PEDAL

(3) Disconnect the wiring harness connector from the switch if necessary.

(4) Hold the brake lamp switch firmly in one hand. Using the other hand, pull outward on the plunger of the switch until it has ratcheted out to its fully extended position.

(5) Place a small amount of multipurpose grease on the bracket attached to the brake pedal where the brake lamp switch plunger contacts it once installed.

(6) Connect the wiring harness connector to the brake lamp switch if previously disconnected.

(7) Install the brake lamp switch in the brake pedal bracket (Fig. 186). Install it using the following procedure:

- Depress the brake pedal as far down as possible.
- Install the switch in its bracket by aligning the index tab on the switch with the slot in the mounting bracket.
- When the switch is fully seated in its bracket, rotate the switch clockwise approximately 30° to lock

ADJUSTMENTS (Continued)

the switch into place. It should be aligned straight up and down (Fig. 186).

CAUTION: Do not use excessive force when pulling back on the brake pedal to adjust the brake lamp switch. If too much force is used, the switch or striker can be damaged.

(8) Gently release/pull back on the brake pedal until the pedal stops moving. This will ratchet the switch plunger backward to the correct adjustment position.

(9) Check the brake lamps to verify they are operating properly and not staying on when the pedal is in the released position.

(10) Reinstall the trim cover below the steering column and lower steering column cover.

SPECIFICATIONS

BRAKE FLUID

The brake fluid used in this vehicle must conform to DOT 3 specifications and SAE J1703 standards. No other type of brake fluid is recommended or approved for usage in the vehicle brake system. Use only Mopar brake fluid or an equivalent from a tightly sealed container.

CAUTION: Never use reclaimed brake fluid or fluid from an container which has been left open. An open container of brake fluid will absorb moisture from the air and contaminate the fluid.

CAUTION: Never use any type of a petroleum-based fluid in the brake hydraulic system. Use of such type fluids will result in seal damage of the vehicle brake hydraulic system causing a failure of the vehicle brake system. Petroleum based fluids would be items such as engine oil, transmission fluid, power steering fluid, etc.

BRAKE ACTUATION SYSTEM

ACTUATION:

Vacuum Operated Power Brakes	Standard
Hydraulic System	Dual-Diagonally Split
Antilock Brake System (Teves Mark-20)	

MASTER CYLINDER ASSEMBLY:

Supplier	Bosch
Type For Non-ABS And ABS Brakes	Conventional Compensating Port Type For ABS Brakes With Traction Control
Body Material	Dual Center Port Design
Reservoir Material	Anodized Aluminum Polypropylene

MASTER CYLINDER BORE / STROKE AND SPLIT:

ABS W/Disc/Drum Brakes . . .	23.8 mm x 36 mm (.937 in. x 1.47 in.)
AWD W/Disc/Disc Brakes . . .	25.4 mm x 39 mm (1.00 in. x 1.50 in.)
Displacement Split	50 / 50

MASTER CYLINDER FLUID OUTLET PORTS:

Non-ABS And ABS	Primary 7/16-24 Secondary 7/16-24
ABS With Traction Control	Primary M12 x 1 Secondary M12 x 1

Outlet Fitting Type Non-ABS And ABS	Double Wall Inverted Flare
Traction Control	ISO Flare

ABS HYDRAULIC CONTROL UNIT:

Hydraulic Tube Fitting Type	ISO Flare
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BOOSTER:

Make/Type	Bosch Vacuum Assist
Mounting Studs	M8 x 1.25
Type	270 ZLT RSMV
Boost At 20 inches Of Manifold	
Vacuum	3800 N·m (850 lbs.)

PROPORTIONING VALVE:

Material	Aluminum
Function . . .	Hydraulic Pressure Proportioning To Rear Brakes

BRAKE PEDAL

Pedal Ratio	3.36
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SPECIFICATIONS (Continued)

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION TORQUE

Master Cylinder:

Mounting Nut 25 N·m (225 in. lbs.)

Power Brake Booster:

Dash Panel Mounting Nuts 28 N·m
(250 in. lbs.)

Brake Tubes And Hoses:

Tube Nuts 17 N·m (145 in. lbs.)

Hose Intermediate Bracket bolt 12 N·m
(105 in. lbs.)

Hose To Caliper Banjo Bolt 47 N·m (35 ft. lbs.)

Junction Block (Non-ABS Brakes)

To Suspension Cradle Mounting Bolt 28 N·m
(250 in. lbs.)

Proportioning Valve (Fixed-ABS):

Frame Rail Attaching Bolts 14 N·m (125 in. lbs.)

Proportioning Valve (Height Sensing-Non-ABS):

Mounting Bracket Attaching Bolts 23 N·m
(200 in. lbs.)Actuator Assembly Adjustment Nut 5 N·m
(45 in. lbs.)Mounting Bracket To Frame Rail Bolts 17 N·m
(150 in. lbs.)

Disc Brake Caliper (All):

Guide Pin Bolts 22 N·m (195 in. lbs.)

Bleeder Screw 15 N·m (125 in. lbs.)

Drum Brake Wheel Cylinder (Rear):

Support Plate Mounting Bolts 8 N·m
(75 in. lbs.)

Bleeder Screw 10 N·m (80 in. lbs.)

Drum Brake Support Plate:

To Rear Axle Mounting Bolts 130 N·m
(95 ft. lbs.)

Parking Brake:

Lever (Pedal) Mounting Bolts 28 N·m
(250 in. lbs.)

Integrated Control Unit (ABS):

Mounting Bracket To Suspension
Cradle Bolts 28 N·m (250 in. lbs.)Mounting Bracket Isolator
Attaching Bolts 11 N·m (97 in. lbs.)CAB To HCU Mounting Screws 2 N·m
(17 in. lbs.)

Wheel Speed Sensor (ASB):

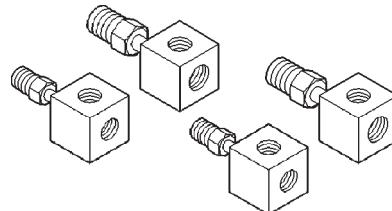
To Axle Or Steering Knuckle
Mounting Bolt 12 N·m (105 in. lbs.)

Tire And Wheel Assembly:

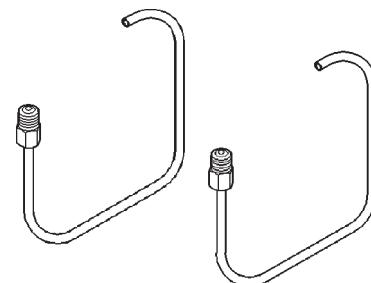
Wheel Mounting Nut 135 N·m (100 ft. lbs.)

SPECIAL TOOLS

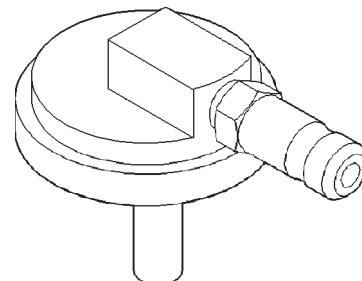
BASE BRAKE SYSTEM



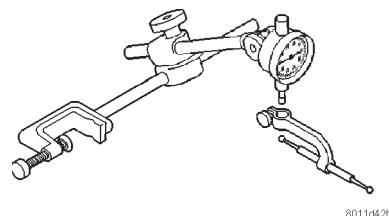
Fittings, Brake Proportioning Valve Testing 6833



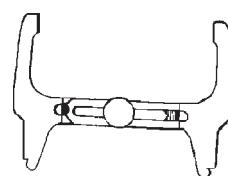
Tubes, Master Cylinder Bleeding 6920



Adapter, Master Cylinder Pressure Bleed Cap 6921

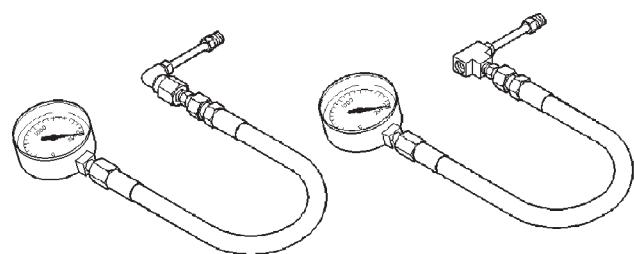


Dial Indicator, C-3339

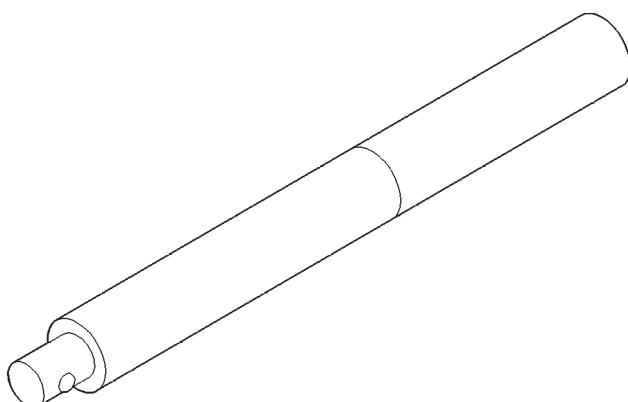
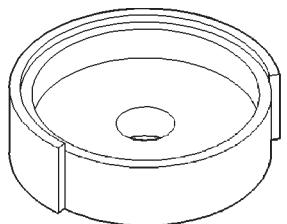


Gauge, Brake Safe-Set

SPECIAL TOOLS (Continued)



8011d474

Gauge Set, C-4007-A*Handle, Universal C-4171*

8011d811

Installer, Dust Boot C-4689

ANTILOCK BRAKE SYSTEM

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ANTILOCK BRAKE SYSTEM	
DESCRIPTION	
This section covers the physical and operational descriptions and the on-car service procedures for the Mark 20i Antilock Brake System and the Mark 20i Antilock Brake System with traction control.	
The purpose of the antilock brake system (ABS) is to prevent wheel lockup under braking conditions on virtually any type of road surface. Antilock braking is desirable because a vehicle that is stopped without locking the wheels retains directional stability and some steering capability. This allows the driver to retain greater control of the vehicle during braking.	
OPERATION	
There are a few performance characteristics of the Mark 20i Antilock Brake System that may at first seem abnormal, but in fact are normal. These characteristics are described below.	
NORMAL BRAKING	
Under normal braking conditions, the ABS functions the same as a standard base brake system with a diagonally split master cylinder and conventional vacuum assist.	
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ABS BRAKING

ABS operation is available at all vehicle speeds above 3–5 mph. If a wheel locking tendency is detected during a brake application, the brake system enters the ABS mode. During ABS braking, hydraulic pressure in the four wheel circuits is modulated to prevent any wheel from locking. Each wheel circuit is designed with a set of electric solenoids to allow modulation, although for vehicle stability, both rear wheel solenoids receive the same electrical signal. Wheel lockup may be perceived at the very end of an ABS stop and is considered normal.

During an ABS stop, the brakes hydraulic system is still diagonally split. However, the brake system pressure is further split into three control channels. During antilock operation of the vehicle's brake system, the front wheels are controlled independently and are on two separate control channels, and the rear wheels of the vehicle are controlled together.

The system can build and release pressure at each wheel, depending on signals generated by the wheel speed sensors (WSS) at each wheel and received at the controller antilock brake (CAB).

NOISE AND BRAKE PEDAL FEEL

During ABS braking, some brake pedal movement may be felt. In addition, ABS braking will create ticking, popping, or groaning noises heard by the driver. This is normal and is due to pressurized fluid being transferred between the master cylinder and

DESCRIPTION AND OPERATION (Continued)

the brakes. If ABS operation occurs during hard braking, some pulsation may be felt in the vehicle body due to fore and aft movement of the suspension as brake pressures are modulated.

At the end of an ABS stop, ABS is turned off when the vehicle is slowed to a speed of 3-4 mph. There may be a slight brake pedal drop anytime that the ABS is deactivated, such as at the end of the stop when the vehicle speed is less than 3 mph or during an ABS stop where ABS is no longer required. These conditions exist when a vehicle is being stopped on a road surface with patches of ice, loose gravel, or sand on it. Also, stopping a vehicle on a bumpy road surface activates ABS because of the wheel hop caused by the bumps.

TIRE NOISE AND MARKS

Although the ABS system prevents complete wheel lockup, some wheel slip is desired in order to achieve optimum braking performance. Wheel slip is defined as follows: 0 percent slip means the wheel is rolling freely and 100 percent slip means the wheel is fully locked. During brake pressure modulation, wheel slip is allowed to reach up to 25-30 percent. This means that the wheel rolling velocity is 25-30 percent less than that of a free rolling wheel at a given vehicle speed. This slip may result in some tire chirping, depending on the road surface. This sound should not be interpreted as total wheel lockup.

Complete wheel lockup normally leaves black tire marks on dry pavement. The ABS will not leave dark black tire marks since the wheel never reaches a fully locked condition. However, tire marks may be noticeable as light patched marks.

START-UP CYCLE

When the ignition is turned on, a popping sound and a slight brake pedal movement may be noticed. The ABS warning lamp will also be on for up to 5 seconds after the ignition is turned on. When the vehicle is first driven off, a humming may be heard or felt by the driver at approximately 20-40 kph (12-25 mph). All of these conditions are a normal function of ABS as the system is performing a diagnosis check.

PREMATURE ABS CYCLING

Symptoms of premature ABS cycling include: clicking sounds from the solenoid valves; pump/motor running; and pulsations in the brake pedal. Premature ABS cycling can occur at any braking rate of the vehicle and on any type of road surface. Neither the red BRAKE warning lamp, nor the amber ABS warning lamp, illuminate and no fault codes are stored in the CAB.

Premature ABS cycling is a condition that needs to be correctly assessed when diagnosing problems with

the antilock brake system. It may be necessary to use a DRB scan tool to detect and verify premature ABS cycling.

Check the following common causes when diagnosing premature ABS cycling: damaged tone wheels; incorrect tone wheels; damaged steering knuckle wheel speed sensor mounting bosses; loose wheel speed sensor mounting bolts; excessive tone wheel runout; or an excessively large tone wheel-to-wheel speed sensor air gap. Give special attention to these components when diagnosing a vehicle exhibiting premature ABS cycling.

After diagnosing the defective component, repair or replace it as required. When the component repair or replacement is completed, test drive the vehicle to verify that premature ABS cycling has been corrected.

ANTILOCK BRAKE SYSTEM COMPONENTS

The following is a detailed description of the antilock brake system components. For information on servicing base brake system components used in conjunction with these components, see the Base Brake System found at the beginning of this service manual group.

MASTER CYLINDER

DESCRIPTION

Three different master cylinders are used depending on whether or not the ABS system is equipped with or without traction control and with or without All-Wheel-Drive.

A vehicle equipped with ABS without traction control uses the same type of master cylinder (Fig. 1) as a vehicle without antilock brakes.

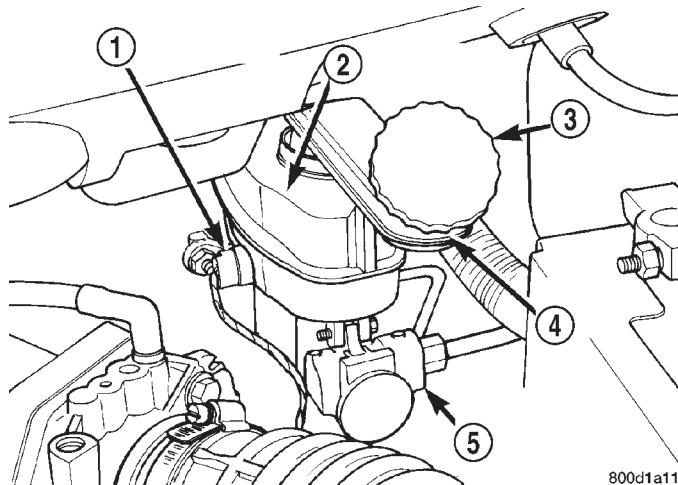


Fig. 1 Master Cylinder

- 1 - BRAKE FLUID LOW LEVEL SWITCH
- 2 - BRAKE FLUID RESERVOIR
- 3 - CAP
- 4 - FILLER NECK
- 5 - MASTER CYLINDER ASSEMBLY

DESCRIPTION AND OPERATION (Continued)

A vehicle equipped with ABS with traction control uses a unique center port master cylinder.

A vehicle equipped with All-Wheel-Drive (AWD) (which have four-wheel disc brakes) and ABS (without traction control) also uses a unique master cylinder. The master cylinder used on this vehicle has a piston bore diameter which is larger than the master cylinder used on the other brake applications.

Master cylinders on vehicles with traction control use ISO fittings at the outlet ports, while vehicles without traction control use standard double inverted flares.

Service is the same on all master cylinders. Refer to the Base Brake section of this service manual group for further information.

OPERATION

When the brake pedal is depressed, the master cylinder primary and secondary pistons apply brake pressure through the master cylinder's primary and secondary outlet ports and the chassis brake tubes leading directly to the integrated control unit (ICU).

INTEGRATED CONTROL UNIT (ICU)

DESCRIPTION

The hydraulic control unit (HCU) and the controller antilock brake (CAB) used with this antilock brake system are combined (integrated) into one unit, which is called the integrated control unit (ICU) (Fig. 2). The ICU is located on the driver's side of the front suspension cradle under the vehicle (Fig. 3).

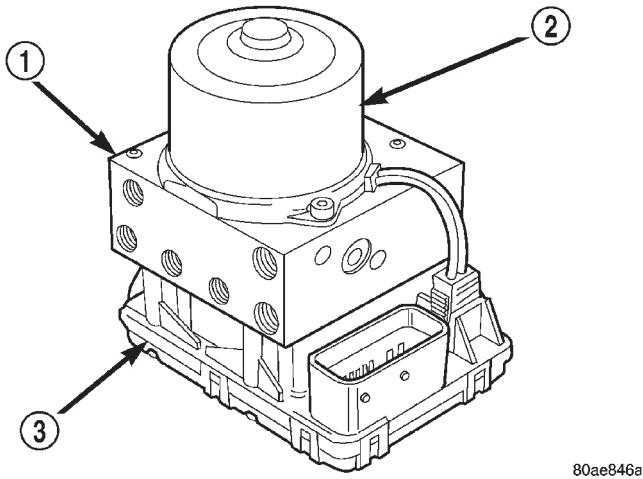


Fig. 2 Integrated Control Unit (ICU)

- 1 - HCU
- 2 - PUMP/MOTOR
- 3 - CAB

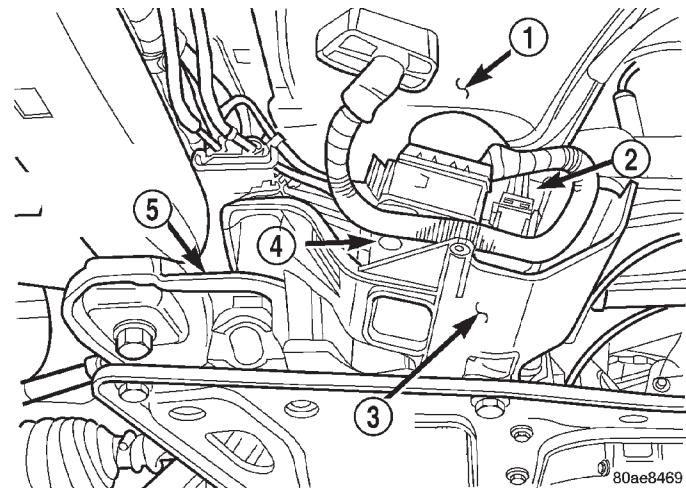


Fig. 3 ICU Mounting Location

- 1 - FLOOR PAN
- 2 - HCU
- 3 - ICU MOUNTING BRACKET
- 4 - CAB
- 5 - FRONT SUSPENSION CRADLE

Two different HCU's and CAB's are used on this vehicle depending on whether or not the vehicle is equipped with traction control. The HCU on a vehicle equipped with ABS and traction control has a valve block housing that is approximately 1 inch longer on the low pressure fluid accumulators side than a HCU on a vehicle that is equipped with only ABS.

The ABS-only ICU consists of the following components: the CAB, eight (build/decay) solenoid valves (four inlet valves and four outlet valves), valve block, fluid accumulators, a pump, and an electric motor.

The ABS with traction control ICU consists of the following components: the CAB, eight (build/decay) solenoid valves (four inlet valves and four outlet valves), two traction control (ASR) solenoid valves, two hydraulic shuttle valves, valve block, fluid accumulators, a pump, and an electric pump/motor. On vehicles with traction control, the ICU contains a total of 10 solenoid valves. The two ASR valves and solenoids are used to isolate the brake system during traction control operation.

The replaceable components of the ICU are the HCU and the CAB. No attempt should be made to service any individual components of the HCU or CAB.

OPERATION

For information on the operation of the ICU, refer to:

- Controller Antilock Brakes (CAB)
- Hydraulic Control Unit (HCU)
- Hydraulic Circuits And Valve Operation (found elsewhere in this section)

DESCRIPTION AND OPERATION (Continued)

CONTROLLER ANTILOCK BRAKE (CAB)

DESCRIPTION

The controller antilock brake (CAB) is a microprocessor-based device which monitors the ABS system during normal braking and controls it when the vehicle is in an ABS stop. The CAB is mounted to the bottom of the HCU (Fig. 2). The CAB uses a 25-way electrical connector on the vehicle wiring harness. The power source for the CAB is through the ignition switch in the RUN or ON position. The CAB is on the CCD bus.

OPERATION

The primary functions of the (CAB) are to:

- (1) Monitor the antilock brake system for proper operation.
- (2) Detect wheel locking or wheel slipping tendencies by monitoring the speed of all four wheels of the vehicle.
- (3) Control fluid modulation to the wheel brakes while the system is in an ABS mode or the traction control system is activated.
- (4) Store diagnostic information.
- (5) Provide communication to the DRB scan tool while in diagnostic mode.

The CAB constantly monitors the antilock brake system for proper operation. If the CAB detects a fault, it will turn on the amber ABS warning lamp and disable the antilock braking system. The normal base braking system will remain operational.

The CAB continuously monitors the speed of each wheel through the signals generated by the wheel speed sensors to determine if any wheel is beginning to lock. When a wheel locking tendency is detected, the CAB commands the coils to actuate. The CAB commanded coils then open and close the valves in the HCU that modulate brake fluid pressure in some or all of the hydraulic circuits. The CAB continues to control pressure in individual hydraulic circuits until a locking tendency is no longer present.

The CAB contains a self-diagnostic program that monitors the antilock brake system for system faults. When a fault is detected, the amber ABS warning lamp is turned on and the fault diagnostic trouble code (DTC) is then stored in a diagnostic program memory. These DTC's will remain in the CAB memory even after the ignition has been turned off. The DTC's can be read and cleared from the CAB memory by a technician using the DRB scan tool. If not cleared with a DRB scan tool, the fault occurrence and DTC will be automatically cleared from the CAB memory after the identical fault has not been seen during the next 255 key cycles of vehicle operation or 3,500 miles, whichever comes first.

CONTROLLER ANTILOCK BRAKE INPUTS

- Wheel speed sensors (four)
- Stop lamp switch
- Ignition switch
- System relay voltage
- Ground.
- Traction control lamp (if equipped)
- Diagnostic communication (CCD)

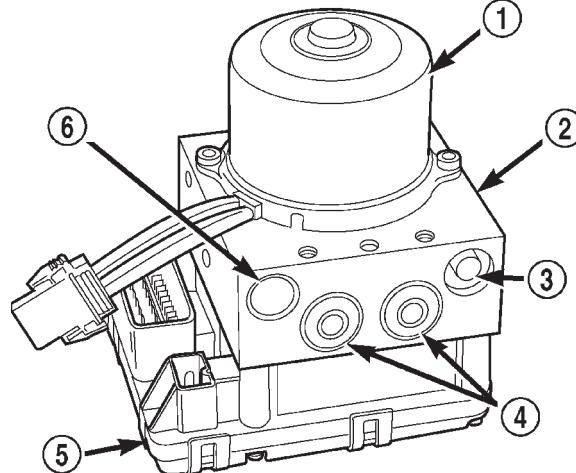
CONTROLLER ANTILOCK BRAKE OUTPUTS

- Body controller communication
- Amber ABS warning lamp actuation
- Traction control lamp (if equipped)
- Diagnostic communication (CCD)

HYDRAULIC CONTROL UNIT (HCU)

DESCRIPTION

The hydraulic control unit (HCU) is mounted to the CAB as part of the ICU (Fig. 4). The ICU is located on the driver's side of the front suspension cradle under the vehicle (Fig. 3). The HCU controls the flow of brake fluid to the brakes using a series of valves and accumulators. A pump/motor is mounted on the HCU to supply build pressure to the brakes during an ABS stop.



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Fig. 4 Integrated Control Unit (ICU)

- 1 - PUMP MOTOR
- 2 - HYDRAULIC CONTROL UNIT (HCU)
- 3 - NOISE DAMPENING CHAMBER
- 4 - LOW PRESSURE FLUID ACCUMULATORS
- 5 - CAB
- 6 - LIP SEAL SAVER

DESCRIPTION AND OPERATION (Continued)

The HCU on a vehicle equipped with ABS and traction control has a valve block housing that is approximately 1 inch longer on the low pressure fluid accumulators side than a HCU on a vehicle that is equipped with only ABS.

For more information, see Integrated Control Unit in this section.

OPERATION

For information on the operation of the HCU as a whole, refer to Hydraulic Circuits And Valve Operation which can be found elsewhere in this section. For information on the operation of the components within the HCU, refer to the following three topics.

VALVES AND SOLENOIDS

The valve block contains four inlet valves and four outlet valves. The inlet valves are spring-loaded in the open position and the outlet valves are spring-loaded in the closed position during normal braking. The fluid is allowed to flow from the master cylinder to the wheel brakes.

During an ABS stop, these valves cycle to maintain the proper slip ratio for each wheel. The inlet valve closes preventing further pressure increase and the outlet valve opens to provide a path from the wheel brake to the HCU accumulators and pump/motor. This releases (decays) pressure from the wheel brake, thus releasing the wheel from excessive slippage. Once the wheel is no longer slipping, the outlet valve is closed and the inlet valve is opened to reapply (build) pressure.

On vehicles with traction control, there is an extra set of valves and solenoids. The ASR valves, mounted in the HCU valve block, are normally in the open position and close only when the traction control is applied.

These isolator valves are used to isolate the rear (non-driving) wheels of the vehicle from the hydraulic pressure that the HCU pump/motor is sending to the front (driving) wheels when traction control is being applied. The rear brakes need to be isolated from the master cylinder when traction control is being applied so the rear wheels do not drag. For more information, refer to Traction Control System in this section.

BRAKE FLUID ACCUMULATORS

There are two fluid accumulators in the HCU—one for the primary hydraulic circuit and one for the secondary hydraulic circuit (Fig. 4). Each hydraulic circuit uses a 5 cc accumulator.

The fluid accumulators temporarily store brake fluid that is removed from the wheel brakes during an ABS cycle. This stored fluid is used by the pump/motor to provide build pressure for the brake hydraulic system. When the antilock stop is complete, the accumulators are drained by the pump/motor.

On ABS-only vehicles, there is a mini-accumulator on the secondary hydraulic circuit that protects the master cylinder seals during an ABS stop, and there is a noise dampening chamber on the primary circuit.

On ABS with traction control vehicles, there are two noise dampening chambers in the HCU.

PUMP/MOTOR

There are two pump assemblies in the HCU—one for the primary hydraulic circuit and one for the secondary hydraulic circuit. Both pumps are driven by a common electric motor (Fig. 4). This DC-type motor is integral to the HCU and is controlled by the CAB.

The pump/motor provides the extra amount of brake fluid needed during antilock braking. Brake fluid is released to the accumulators when the outlet valve is opened during an antilock stop. The pump mechanism consists of two opposing pistons operated by an eccentric camshaft. In operation, one piston draws fluid from the accumulators, and the opposing piston pumps fluid to the master cylinder circuits. When the antilock stop is complete, the pump/motor drains the accumulators.

The CAB may turn on the pump/motor when an antilock stop is detected. The pump/motor continues to run during the antilock stop and is turned off after the stop is complete. Under some conditions, the pump/motor runs to drain the accumulators during the next drive-off.

The pump/motor is not a serviceable item; if it requires replacement, the HCU must be replaced.

DESCRIPTION AND OPERATION (Continued)

PROPORTIONING VALVE

DESCRIPTION

There are two fixed proportioning valves used in the antilock brake system. One valve controls each rear braking circuit, but both are serviced as one assembly. Both proportioning valves are mounted together on a bracket that is attached to the left frame rail near the left rear shock absorber (Fig. 5).

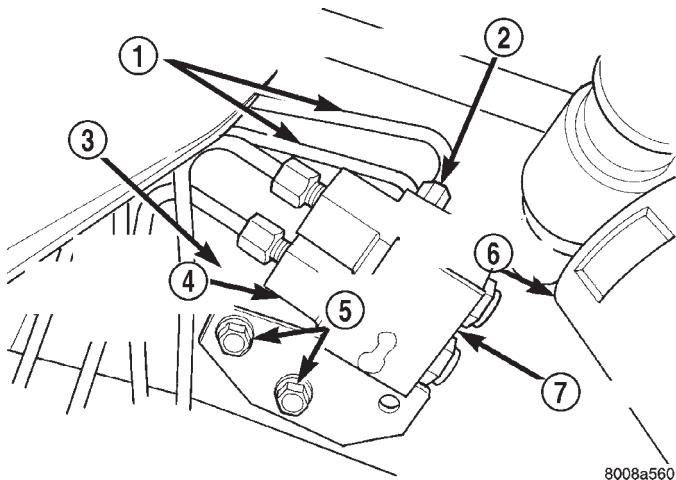


Fig. 5 Proportioning Valve

- 1 – CHASSIS BRAKE LINES FROM ABS MODULATOR
- 2 – LEFT REAR BRAKE PROPORTIONING VALVE
- 3 – LEFT REAR FRAME RAIL
- 4 – RIGHT REAR BRAKE PROPORTIONING VALVE
- 5 – ATTACHING BOLTS
- 6 – SHOCK ABSORBER
- 7 – PROPORTIONING VALVE ASSEMBLY

The fixed proportioning valve is made out of aluminum and has an integral mounting bracket. The fixed proportioning valve assembly has 2 inlet ports for brake fluid coming from the ABS ICU, and 2 outlet ports for brake fluid going to the brakes at each rear wheel.

The fixed proportioning valve is a non-serviceable component and must be replaced as a complete assembly if found to be functioning improperly.

OPERATION

The fixed proportioning valve operates by allowing full hydraulic pressure to the rear brakes up to a set pressure point, called the valve's split point. Beyond this split point the proportioning valve reduces the amount of hydraulic pressure to the rear brakes according to a certain ratio.

Thus, on light brake pedal applications, the proportioning valve allows approximately equal brake hydraulic pressure to be supplied to both the front and rear brakes. On heavier brake pedal applications, the proportioning valve will control hydraulic pressure to the rear brakes, so that hydraulic pressure at the rear brakes will be lower than that at the front brakes. This controlled hydraulic pressure to the rear brakes prevents excessive rear wheel ABS cycling during moderate stops.

ABS FUSES

DESCRIPTION

The ABS system fuse and the ABS pump/motor fuse are located in the power distribution center (PDC). Refer to the sticker on the inside of the PDC cover for the location of these fuses. The PDC is located on the driver's side of the engine compartment. The fuse for the amber ABS warning lamp is located in the fuse junction block under the instrument panel.

If the vehicle is equipped with traction control, the fuse for the traction control switch is located in the fuse junction block under the instrument panel.

ABS RELAYS

DESCRIPTION

Two relays are used to control the antilock brake system. The two relays are the pump/motor relay and the system relay. The pump/motor relay and the system relay are located in the CAB. If either the pump/motor relay or the system relay is diagnosed as not functioning properly, the CAB must be replaced. Refer to Controller Antilock Brake in the Disassembly And Assembly section in this group of the service manual for the procedure.

AMBER ABS WARNING LAMP

DESCRIPTION

The amber ABS warning lamp is located on the right side of the message center located at the top of the instrument panel.

DESCRIPTION AND OPERATION (Continued)

OPERATION

When the ignition key is turned to the ON position, the amber ABS warning lamp is lit until the CAB completes its self-tests and turns off the lamp (approximately 4 seconds). The amber ABS warning lamp will illuminate when the CAB detects a condition that results in the shutdown of ABS function, or when the body controller does not receive a CCD message from the CAB. The CAB turns on the amber ABS warning lamp by grounding the circuit.

Under most conditions, when the amber ABS warning lamp is on, only the ABS function of the brake system is affected; the base brake system and the ability to stop the vehicle are not affected.

The amber ABS warning lamp is controlled by the CAB and the body controller through a diode located in the junction block. The CAB and body controller control the amber ABS warning lamp by directly grounding the circuit.

WHEEL SPEED SENSOR (WSS)

DESCRIPTION

One wheel speed sensor (WSS) and one tone wheel are located at each front and rear wheel. Each front wheel speed sensor is attached to a boss in the steering knuckle (Fig. 6). Each rear wheel speed sensor on All-Wheel-Drive (rear disc brake) applications is mounted to the rear axle flange and disc brake adapter (Fig. 7). Each rear wheel speed sensor on Front-Wheel-Drive (rear drum brake) applications is mounted to the rear axle flange (Fig. 8).

Each front tone wheel on all models is part of the driveshaft outboard constant velocity joint. Each rear tone wheel on All-Wheel-Drive (rear disc brake) models is also part of the outboard constant velocity joint. Each rear tone wheel on Front-Wheel-Drive models is an integral part of the rear wheel hub and bearing.

OPERATION

Each wheel speed sensor sends a small AC signal to the CAB. This signal is generated by magnetic induction created when a toothed sensor ring (tone wheel) passes the stationary magnetic wheel speed sensor. The CAB converts the AC signal into a digital signal. If a wheel locking tendency is detected by the CAB, it will then modulate hydraulic pressure via the HCU to prevent the wheel(s) from locking.

Correct ABS operation is dependent on accurate wheel speed signals. The vehicle's tires and wheels all must be the same size and type to generate accurate signals. Variations in tire and wheel size can produce inaccurate wheel speed signals.

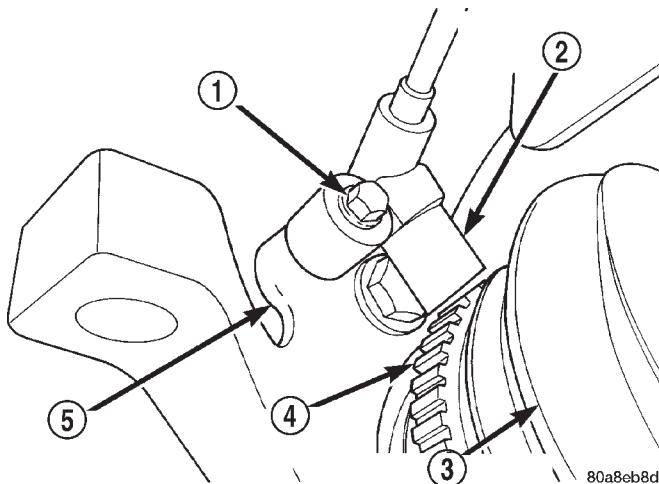


Fig. 6 Front Wheel Speed Sensor

- 1 – MOUNTING BOLT
- 2 – WHEEL SPEED SENSOR
- 3 – DRIVESHAFT
- 4 – TONE WHEEL
- 5 – STEERING KNUCKLE

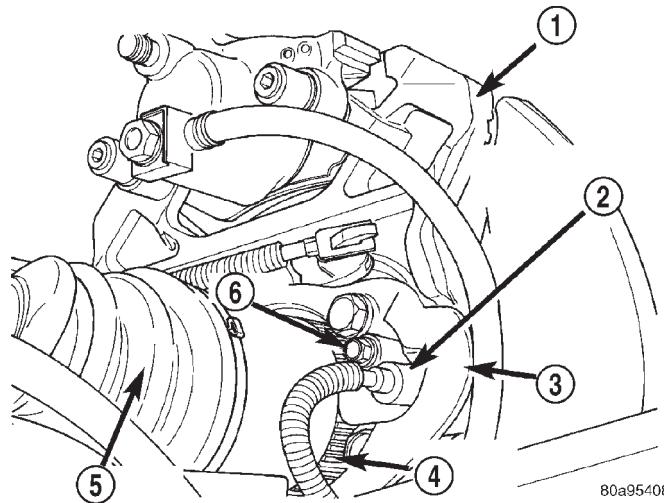
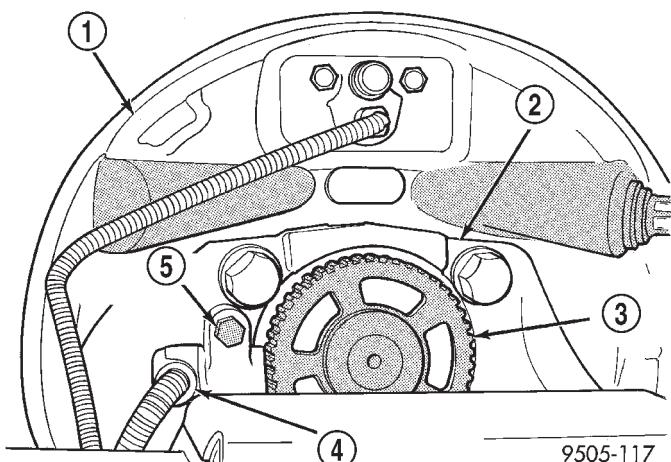


Fig. 7 Rear Wheel Speed Sensor (AWD)

- 1 – ADAPTER
- 2 – WHEEL SPEED SENSOR
- 3 – AXLE
- 4 – TONE WHEEL
- 5 – DRIVESHAFT
- 6 – BOLT

Improper speed sensor-to-tone wheel clearance can cause erratic speed sensor signals. The speed sensor air gap is not adjustable, but should be checked when applicable. Wheel speed sensor-to-tone wheel clearance specifications can be found in the Specifications section in this service manual group.

DESCRIPTION AND OPERATION (Continued)

**Fig. 8 Rear Wheel Speed Sensor (FWD)**

- 1 – BRAKE SUPPORT PLATE
 2 – REAR AXLE
 3 – TONE WHEEL
 4 – WHEEL SPEED SENSOR
 5 – MOUNTING BOLT

TRACTION CONTROL SYSTEM**DESCRIPTION**

Traction control reduces wheel slip and maintains traction at the driving wheels at speeds below 56 kph (35 mph) when road surfaces are slippery. The traction control system reduces wheel slip by braking the wheel that is losing traction.

HYDRAULIC SHUTTLE VALVES

Two pressure relief hydraulic shuttle are included on vehicles with traction control. These valves are located inside the HCU and cannot be serviced separately from the HCU.

TRACTION CONTROL LAMP

The traction control function lamp is located in the transmission range indicator display of the instrument cluster, displaying TRAC, TRAC OFF or neither depending on system mode.

The TRAC OFF lamp is controlled by a Traction Control Off switch that is a momentary contact type switch. The Traction Control Off switch is located on the instrument panel to the left of the steering column.

OPERATION

The traction control module monitors wheel speed. During acceleration, if the module detects front (drive) wheel slip and the brakes are not applied, the module enters traction control mode. Traction control operation proceeds in the following order:

- (1) Close the normally open isolation valves.
- (2) Start the pump/motor and supply volume and pressure to the front (drive) hydraulic circuit. (The

pump/motor runs continuously during traction control operation.)

(3) Open and close the build and decay valves to maintain minimum wheel slip and maximum traction.

The cycling of the build and decay valves during traction control is similar to that during antilock braking, except the valves work to control wheel spin by applying the brakes, whereas the ABS function is to control wheel skid by releasing the brakes.

If the brakes are applied at anytime during a traction control cycle, the brake lamp switch triggers the controller to switch off traction control.

HYDRAULIC SHUTTLE VALVES

Two pressure relief hydraulic shuttle valves allow pressure and volume to return to the master cylinder reservoir when not consumed by the build and decay valves. These valves are necessary because the pump/motor supplies more volume than the system requires.

TRACTION CONTROL LAMP

The traction control system is enabled at each ignition cycle. It may be turned off by depressing the Traction Control Off switch button when the ignition is in the ON position. The traction control function lamp (TRAC OFF) illuminates immediately upon depressing the button.

The traction control function lamp illuminates during a traction control cycle, displaying TRAC.

If the CAB calculates that the brake temperatures are high, the traction control system becomes inoperative until a time-out period has elapsed. During this "thermo-protection mode," the traction control function lamp illuminates TRAC OFF; note that no trouble code is registered.

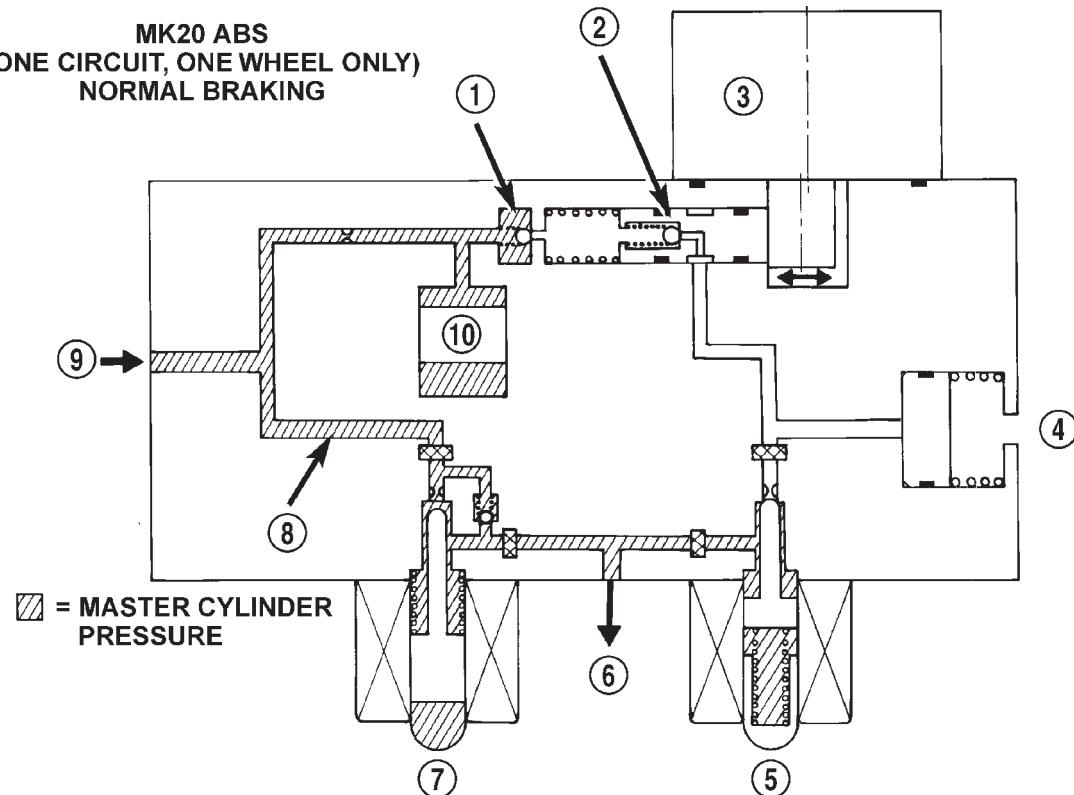
HYDRAULIC CIRCUITS AND VALVE OPERATION

The hydraulic fluid control valves control the flow of pressurized brake fluid to the wheel brakes during the different modes of ABS braking. The following paragraphs explain how this works. For purposes of explanation only, it is assumed that only the right front wheel is experiencing antilock braking; the following diagrams show only the right front wheel in an antilock braking operation.

NORMAL BRAKING HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION

The hydraulic diagram (Fig. 9) shows the vehicle in the normal braking mode of the base brake hydraulic system. The diagram shows no wheel spin or slip occurring relative to the speed of the vehicle. The driver is applying the brake pedal which builds pressure in the brake hydraulic system to engage the brakes and stop the vehicle.

DESCRIPTION AND OPERATION (Continued)



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Fig. 9 Normal Braking Hydraulic Circuit

- | | |
|---------------------------------|-------------------------------|
| 1 – OUTLET VALVE | 6 – TO RIGHT FRONT WHEEL |
| 2 – PUMP PISTON | 7 – NORMALLY OPEN VALVE (OFF) |
| 3 – PUMP MOTOR (OFF) | 8 – MASTER CYLINDER PRESSURE |
| 4 – LOW PRESSURE ACCUMULATOR | 9 – FROM MASTER CYLINDER |
| 5 – NORMALLY CLOSED VALVE (OFF) | 10 – NOISE DAMPER CHAMBER |

ABS PRIMARY HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION (ABS WITHOUT TRACTION CONTROL)

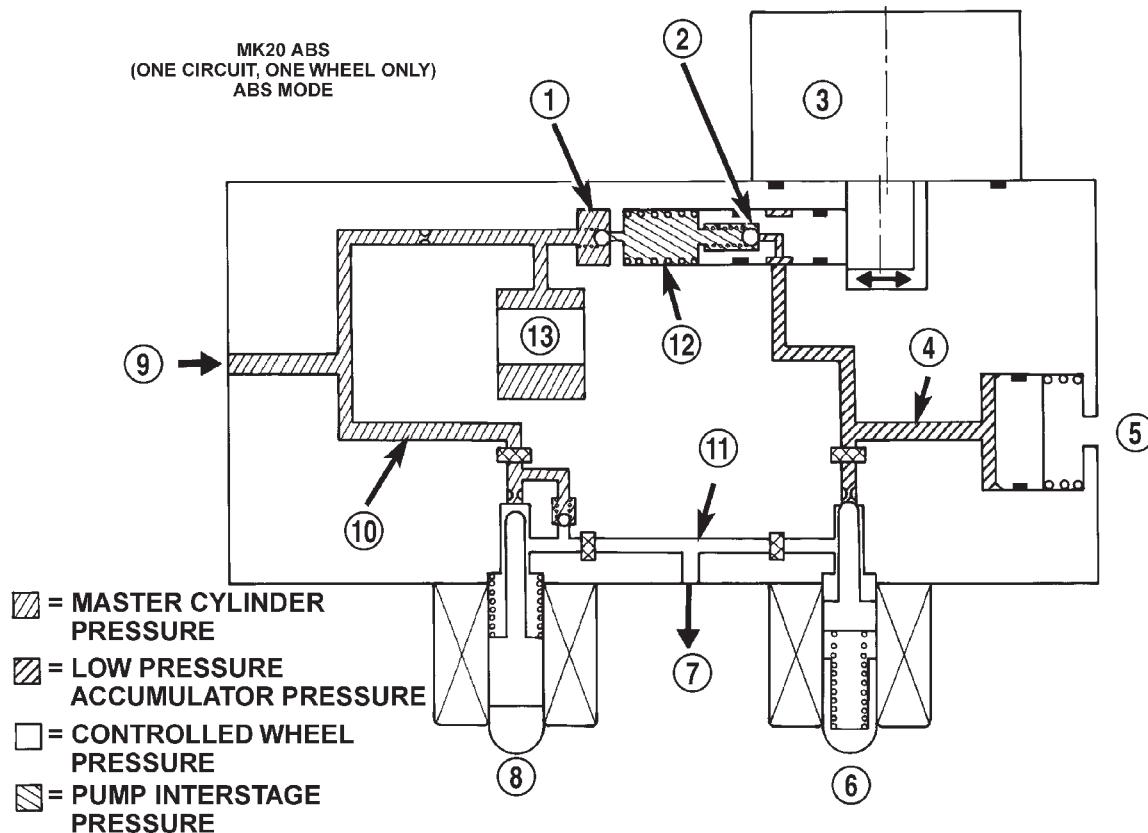
The hydraulic diagram (Fig. 10) shows the vehicle in the ABS braking mode. The diagram shows one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than is allowed by the surface on which the tires are riding.

- The normally open and normally closed valves modulate (build/decay) the brake hydraulic pressure as required.

- The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits.

- The brake fluid is routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.

DESCRIPTION AND OPERATION (Continued)



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Fig. 10 ABS Without Traction Control - Primary Hydraulic Circuit

- 1 - OUTLET VALVE
- 2 - PUMP PISTON
- 3 - PUMP MOTOR (ON)
- 4 - LOW PRESSURE ACCUMULATOR PRESSURE
- 5 - LOW PRESSURE ACCUMULATOR
- 6 - NORMALLY CLOSED VALVE (MODULATING)
- 7 - TO RIGHT FRONT WHEEL

- 8 - NORMALLY OPEN VALVE (MODULATING)
- 9 - FROM MASTER CYLINDER
- 10 - MASTER CYLINDER PRESSURE
- 11 - CONTROLLED WHEEL PRESSURE
- 12 - PUMP INTERSTAGE PRESSURE
- 13 - NOISE DAMPER CHAMBER

ABS SECONDARY HYDRAULIC CIRCUIT AND SOLENOID VALVE FUNCTION (ABS WITHOUT TRACTION CONTROL)

The hydraulic diagram (Fig. 11) shows the vehicle in the ABS braking mode. The diagram shows one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than is allowed by the surface on which the tires are riding.

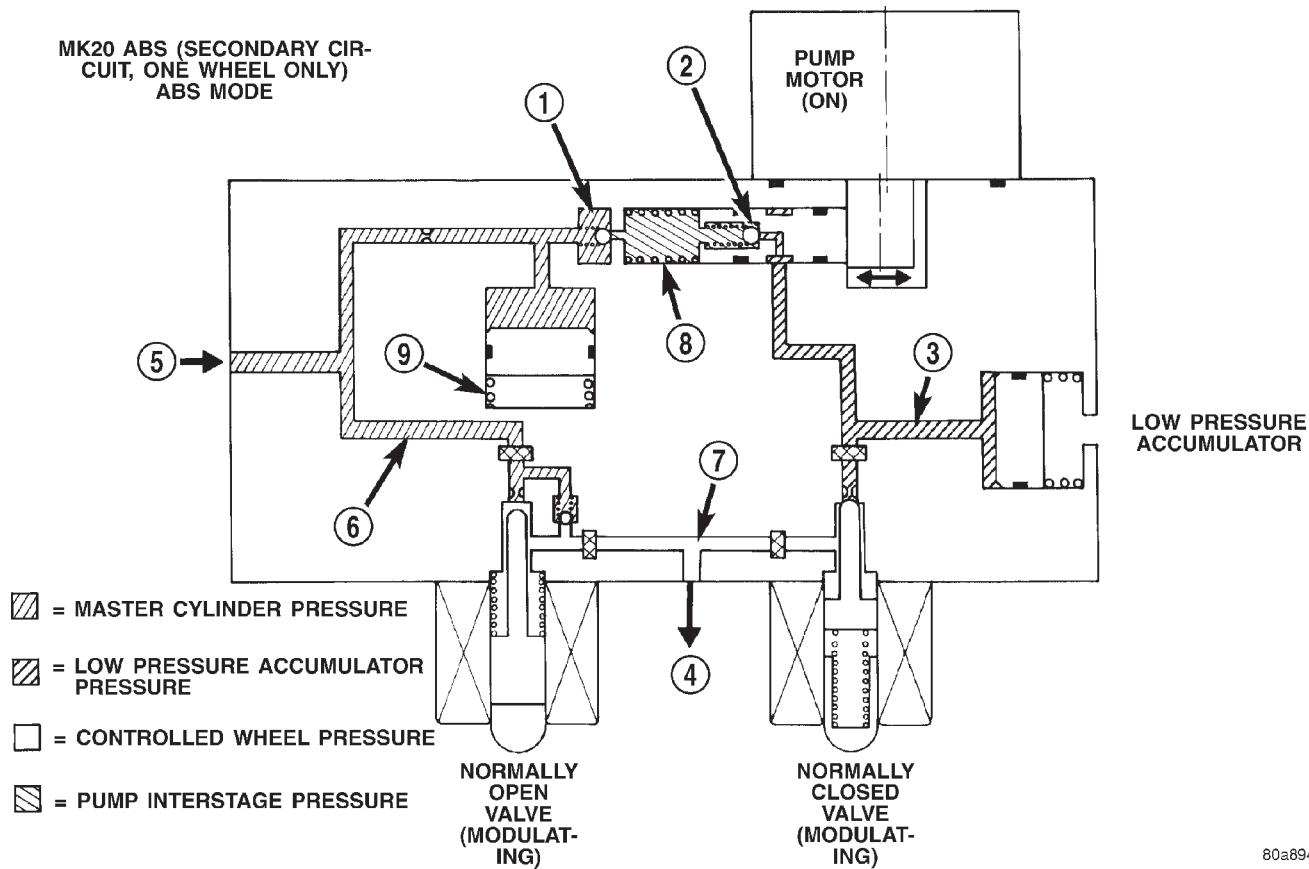
- The normally open and normally closed valves modulate (build/decay) the brake hydraulic pressure as required.

- The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits.

- The brake fluid will then be routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.

- In the secondary circuit, 1.2 cc brake fluid is taken in by the lip seal saver to protect the lip seals on the master cylinder piston.

DESCRIPTION AND OPERATION (Continued)



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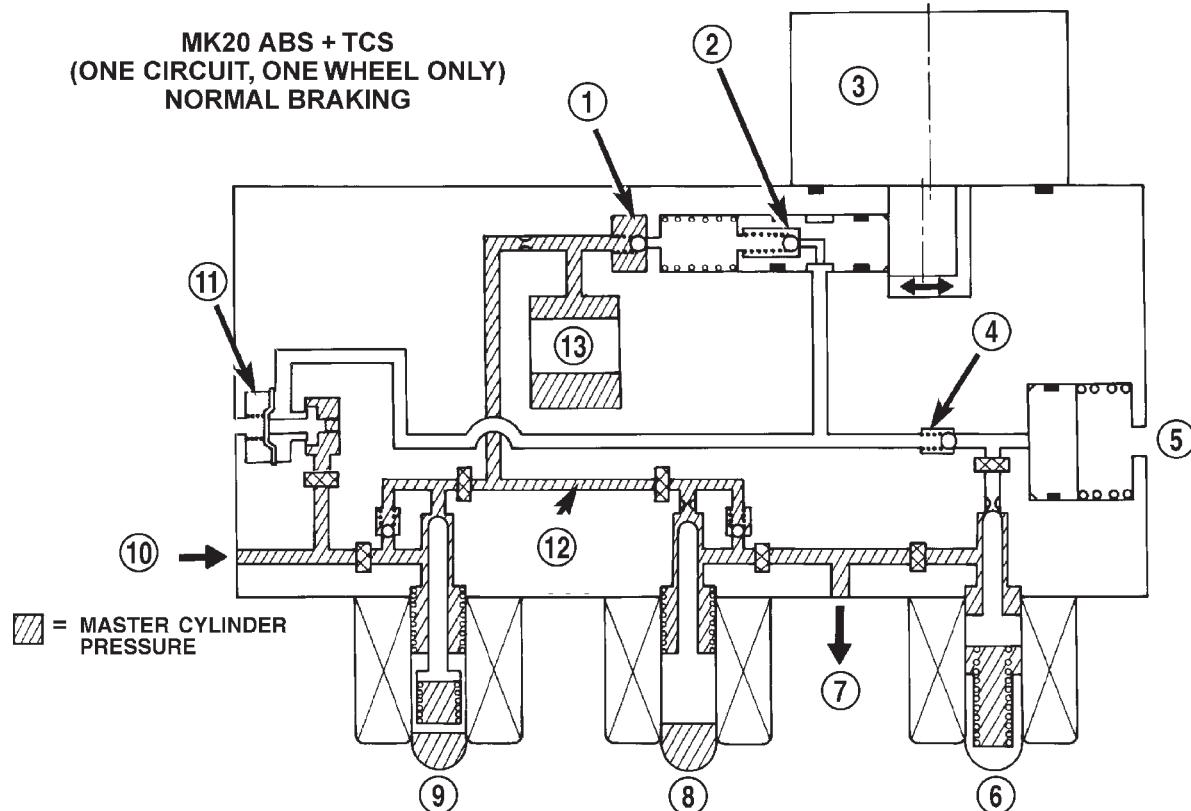
Fig. 11 ABS Without Traction Control - Secondary Hydraulic Circuit

- 1 – OUTLET VALVE
 2 – PUMP PISTON
 3 – LOW PRESSURE ACCUMULATOR PRESSURE
 4 – TO RIGHT FRONT WHEEL
 5 – FROM MASTER CYLINDER
- 6 – MASTER CYLINDER PRESSURE
 7 – CONTROLLED WHEEL PRESSURE
 8 – PUMP INTERSTAGE PRESSURE
 9 – LIP SEAL SAVER (SECONDARY CIRCUIT ONLY)

NORMAL BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 12) shows a vehicle with traction control in the normal braking mode. The diagram shows no wheel spin or slip occurring relative to the speed of the vehicle. The driver is applying the brake pedal which builds pressure in the brake hydraulic system to engage the brakes and stop the vehicle. The hydraulic shuttle valve closes with every brake pedal application so pressure is not created at the inlet to the pump/motor.

DESCRIPTION AND OPERATION (Continued)



80a89438

Fig. 12 ABS With Traction Control - Normal Braking Hydraulic Circuit

- | | |
|---------------------------------|-----------------------------------|
| 1 - OUTLET VALVE | 8 - NORMALLY OPEN VALVE (OFF) |
| 2 - PUMP PISTON | 9 - NORMALLY OPEN ASR VALVE (OFF) |
| 3 - PUMP MOTOR (OFF) | 10 - FROM MASTER CYLINDER |
| 4 - SUCTION VALVE | 11 - HYDRAULIC SHUTTLE VALVE |
| 5 - LOW PRESSURE ACCUMULATOR | 12 - MASTER CYLINDER PRESSURE |
| 6 - NORMALLY CLOSED VALVE (OFF) | 13 - NOISE DAMPER CHAMBER |
| 7 - TO RIGHT FRONT WHEEL | |

ABS BRAKING HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

The hydraulic diagram (Fig. 13) shows the vehicle in the ABS braking mode. The diagram shows one wheel is slipping because the driver is attempting to stop the vehicle at a faster rate than is allowed by the surface on which the tires are riding.

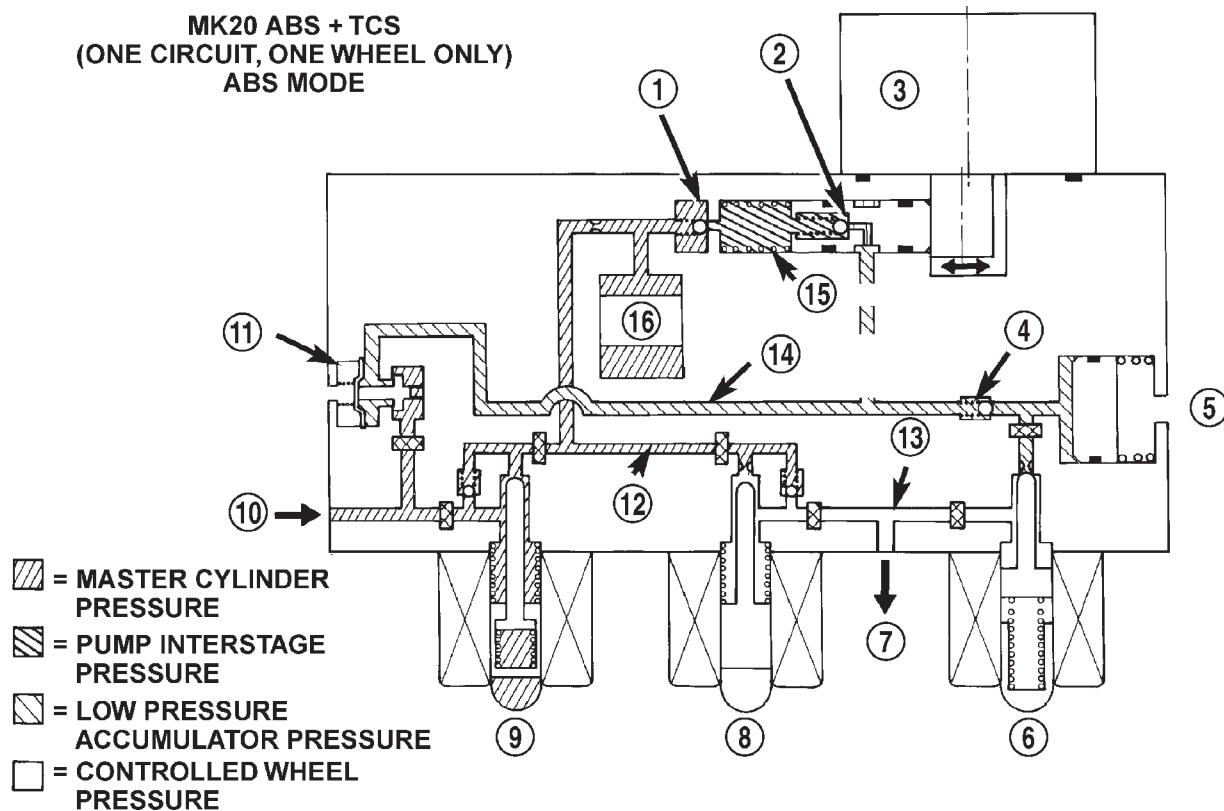
- The hydraulic shuttle valve closes upon brake application so that the pump/motor cannot siphon brake fluid from the master cylinder.

- The normally open and normally closed valves modulate (build/decay) the brake hydraulic pressure as required.

- The pump/motor is switched on so that the brake fluid from the low pressure accumulators is returned to the master cylinder circuits.

- The brake fluid is routed to either the master cylinder or the wheel brake depending on the position of the normally open valve.

DESCRIPTION AND OPERATION (Continued)



80a89439

Fig. 13 ABS With Traction Control - ABS Braking Hydraulic Circuit

- 1 - OUTLET VALVE
- 2 - PUMP PISTON
- 3 - PUMP MOTOR (ON)
- 4 - SUCTION VALVE
- 5 - LOW PRESSURE ACCUMULATOR
- 6 - NORMALLY CLOSED VALVE (MODULATING)
- 7 - TO RIGHT FRONT WHEEL
- 8 - NORMALLY OPEN VALVE (MODULATING)

- 9 - NORMALLY OPEN ASR VALVE (OFF)
- 10 - FROM MASTER CYLINDER
- 11 - HYDRAULIC SHUTTLE VALVE
- 12 - MASTER CYLINDER PRESSURE
- 13 - CONTROLLED WHEEL PRESSURE
- 14 - LOW PRESSURE ACCUMULATOR PRESSURE
- 15 - PUMP INTERSTAGE PRESSURE
- 16 - NOISE DAMPER CHAMBER

ABS TRACTION CONTROL HYDRAULIC CIRCUIT, SOLENOID VALVE, AND SHUTTLE VALVE FUNCTION (ABS WITH TRACTION CONTROL)

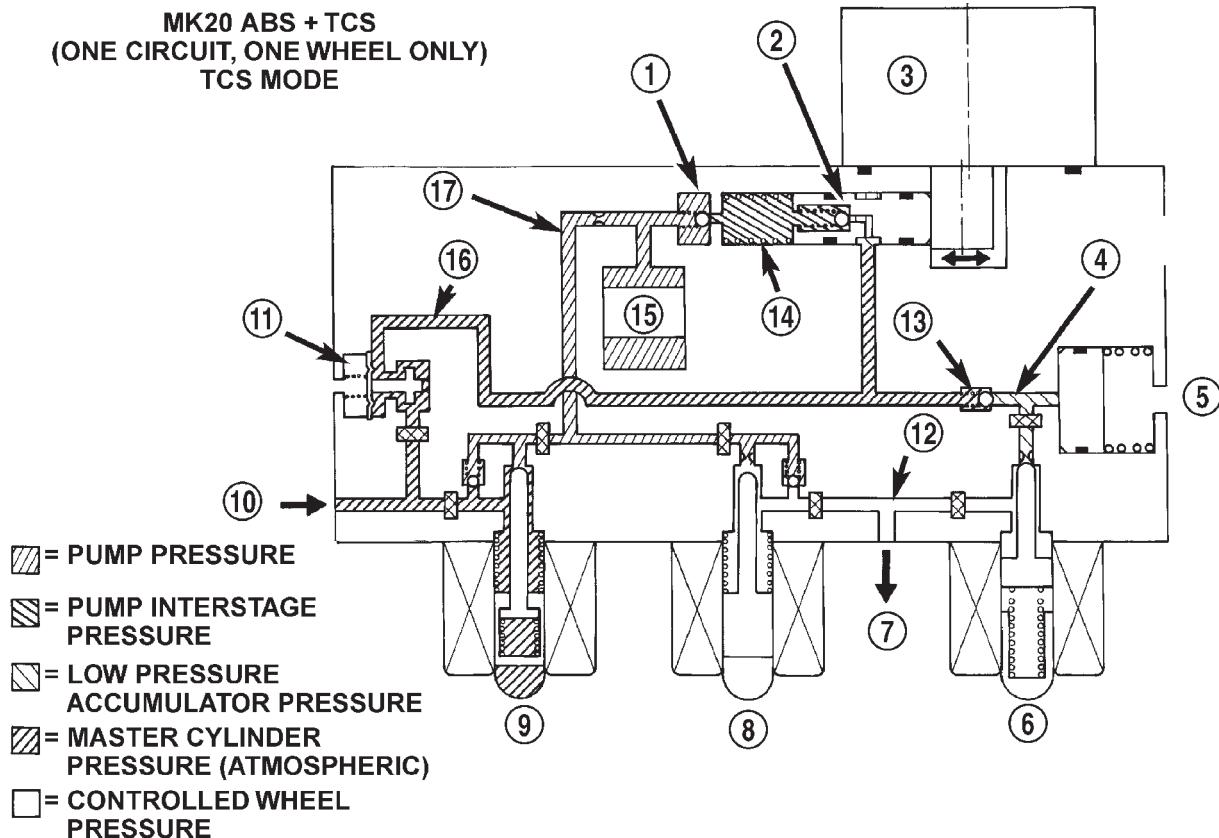
The hydraulic diagram (Fig. 14) shows the vehicle in the ABS braking mode. The diagram shows a drive wheel is spinning and brake pressure is required to reduce its speed.

- The normally open ASR valve is energized to isolate the brake fluid being pumped from the master cylinder and to isolate the driven wheel.

- The normally open ASR valve bypasses the pump output back to the master cylinder at a fixed pressure setting.

- The normally open and normally closed valves modulate (build/decay) the brake pressure as required to the spinning wheel.

DESCRIPTION AND OPERATION (Continued)



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Fig. 14 Traction Control Hydraulic Circuit

- | | |
|---|--------------------------------|
| 1 – OUTLET VALVE | 10 – FROM MASTER CYLINDER |
| 2 – PUMP PISTON | 11 – HYDRAULIC SHUTTLE VALVE |
| 3 – PUMP MOTOR (ON) | 12 – CONTROLLED WHEEL PRESSURE |
| 4 – LOW PRESSURE ACCUMULATOR PRESSURE | 13 – SUCTION VALVE |
| 5 – LOW PRESSURE ACCUMULATOR | 14 – PUMP INTERSTAGE PRESSURE |
| 6 – NORMALLY CLOSED VALVE (MODULATING) | 15 – NOISE DAMPER CHAMBER |
| 7 – TO RIGHT FRONT WHEEL (SPINNING) | 16 – MASTER CYLINDER PRESSURE |
| 8 – NORMALLY OPEN VALVE (MODULATING) | 17 – PUMP PRESSURE |
| 9 – NORMALLY OPEN ASR VALVE ON (REGULATING) | |

DIAGNOSIS AND TESTING**SERVICE WARNINGS AND CAUTIONS**

The ABS uses an electronic control module, the CAB. This module is designed to withstand normal current draws associated with vehicle operation. Care must be taken to avoid overloading the CAB circuits.

CAUTION: In testing for open or short circuits, do not ground or apply voltage to any of the circuits unless instructed to do so for a diagnostic procedure.

CAUTION: These circuits should only be tested using a high impedance multi-meter or the DRB

scan tool as described in this section. Power should never be removed or applied to any control module with the ignition in the ON position. Before removing or connecting battery cables, fuses, or connectors, always turn the ignition to the OFF position.

CAUTION: Use only factory wiring harnesses. Do not cut or splice wiring to the brake circuits. The addition of after-market electrical equipment (car phone, radar detector, citizen band radio, trailer lighting, trailer brakes, etc.) on a vehicle equipped with antilock brakes may affect the function of the antilock brake system.

DIAGNOSIS AND TESTING (Continued)

ABS GENERAL DIAGNOSTICS INFORMATION

This section contains information necessary to diagnose the antilock brake system. Specifically, this section should be used to help diagnose conditions which result in any of the following:

- (1) amber ABS warning lamp turned on.
- (2) brakes lock-up on hard application.

Diagnosis of base brake conditions that are obviously mechanical in nature should be directed to BASE BRAKE SYSTEM at the beginning of this group.

Many ABS conditions judged to be a problem by the driver may be normal operating conditions. See ABS OPERATION in the DESCRIPTION AND OPERATION section of this group to become familiarized with the normal characteristics of this antilock brake system.

ABS WIRING DIAGRAM INFORMATION

During the diagnosis and testing of the antilock brake system it may become necessary to reference the wiring diagrams covering the antilock brake system and its components. For wiring diagrams refer to GROUP 8W of this service manual. It will provide you with the wiring diagrams and the circuit description and operation information covering the antilock brake system.

ABS VEHICLE TEST DRIVE

Most ABS complaints will require a test drive to properly duplicate and diagnose the condition.

WARNING: CONDITIONS THAT RESULT IN TURNING ON THE RED BRAKE WARNING LAMP MAY INDICATE REDUCED BRAKING ABILITY.

Before test driving a brake complaint vehicle, note whether the red BRAKE warning lamp, amber ABS warning lamp, or both are turned on. If it is the red BRAKE warning lamp, there is a brake hydraulic problem that must be corrected before driving the vehicle. Refer to the BASE BRAKE SYSTEM for diagnosis of the red BRAKE warning lamp.

If the amber ABS warning lamp is on, test drive the vehicle as described below. While the amber ABS warning lamp is on, the ABS is not functional. The ability to stop the car using the base brake system should not be affected.

If a functional problem of the ABS is determined while test driving the vehicle, refer to the Chassis Diagnostic Procedures manual.

(1) Turn the key to the OFF position and then back to the ON position. Note whether the amber ABS warning lamp continues to stay on. If it does, refer to the diagnostic manual.

(2) If the amber ABS warning lamp goes out, shift into gear and drive the car to a speed of 25 kph (15 mph) to complete the ABS start-up and drive-off cycles (see ABS ELECTRONIC DIAGNOSIS). If at this time the amber ABS warning lamp comes on, refer to the diagnostic manual.

(3) If the amber ABS warning lamp remains out, drive the vehicle a short distance. Accelerate the vehicle to a speed of at least 64 kph (40 mph). Bring the vehicle to a complete stop, braking hard enough to cause the ABS to cycle. Again accelerate the vehicle past 40 kph (25 mph). Refer to the diagnostic manual for further testing of the antilock brake system.

ABS ELECTRONIC DIAGNOSIS

The following information is presented to give the technician a general background on the diagnostic capabilities of the ABS system. Complete electronic diagnosis of the ABS system used on this vehicle is covered in the Chassis Diagnostic Procedures manual.

Electronic diagnosis of the ABS system used on this vehicle is performed using the DRB scan tool. The vehicle's scan tool diagnostic connector is located under the steering column lower cover, to the left side of the steering column (Fig. 15).

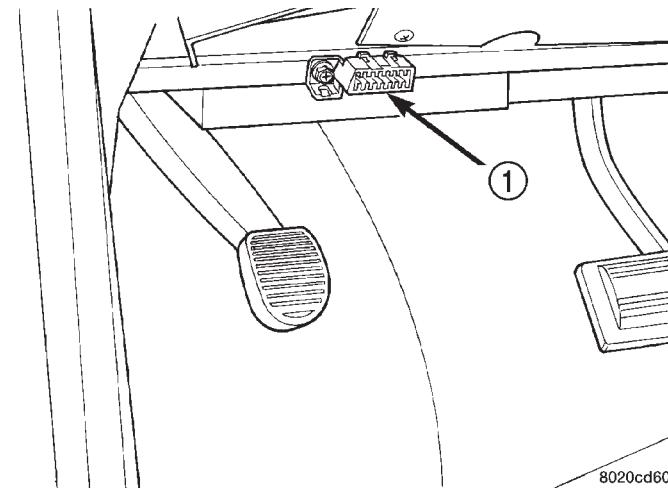


Fig. 15 Diagnostic Connector Location

1 – DIAGNOSTIC CONNECTOR

ABS SELF-DIAGNOSIS

The ABS system is equipped with a self-diagnosis capability, which may be used to assist in the isolation of ABS faults. The features are described below.

START-UP CYCLE

The self-diagnosis ABS start-up cycle begins when the ignition switch is turned to the ON position. Electrical checks are completed on ABS components,

DIAGNOSIS AND TESTING (Continued)

including the CAB, solenoid continuity, and the relay system operation. During this check the amber ABS warning lamp is turned on for approximately 5 seconds and the brake pedal may emit a popping sound, moving slightly when the solenoid valves are checked.

DRIVE-OFF CYCLE

The first time the vehicle is set in motion after an ignition off/on cycle, the drive-off cycle occurs. This cycle is performed when the vehicle reaches a speed of approximately 20 kph (12 mph.).

- The pump/motor is briefly activated to verify function. When the pump/motor is briefly activated, a whirling or buzzing sound may be heard by the driver. This sound is normal, indicating the pump/motor is running.
- The wheel speed sensor output correct operating range is verified.

ONGOING TESTS

While the system is operating, these tests are performed on a continuous basis:

- solenoid continuity
- wheel speed sensor continuity
- wheel speed sensor output

DIAGNOSTIC TROUBLE CODES (DTC's)

Diagnostic trouble codes (DTC's) are kept in the controller's memory until either erased by the technician using the DRB, or erased automatically after 3500 miles or 255 ignition key cycles, whichever occurs first. DTC's are retained by the controller even if the ignition is turned off or the battery is disconnected. More than one DTC can be stored at a time. When accessed, the number of occurrences (ignition key cycles) and the DTC that is stored are displayed. Most functions of the CAB and the ABS system can be accessed by the technician for testing and diagnostic purposes using the DRB.

LATCHING VERSUS NON-LATCHING DIAGNOSTIC TROUBLE CODES

Some DTC's detected by the CAB are "latching" codes. The DTC is latched and ABS braking is disabled until the ignition switch is reset. Thus, ABS braking is non-operational even if the original DTC has disappeared. Other DTC's are non-latching. Any warning lamps that are turned on are only turned on as long as the DTC condition exists; as soon as the condition goes away, the amber ABS warning lamp is turned off, although, in most cases, a DTC is set.

INTERMITTENT DIAGNOSTIC TROUBLE CODES

As with virtually any electronic system, intermittent electrical problems in the ABS system may be difficult to accurately diagnose. Most intermittent

electrical problems are caused by faulty electrical connections or wiring. A visual inspection should be done before trying to diagnose or service the antilock brake system; this will eliminate unnecessary diagnosis and testing time. Perform a visual inspection for loose, disconnected, damaged, or misrouted wires or connectors; include the following components and areas of the vehicle in the inspection.

(1) Inspect fuses in the power distribution center (PDC) and the wiring junction block. Verify that all fuses are fully inserted into the PDC and wiring junction block. A label on the underside of the PDC cover identifies the locations of the ABS fuses.

(2) Inspect the 25-way electrical connector at the CAB for damaged, spread, or backed-out wiring terminals. Verify that the 25-way connector is fully inserted in the socket of the CAB. Be sure that wires are not stretched tight or pulled out of the connector.

(3) Verify that all the wheel speed sensor connections are secure.

(4) Look for poor mating of connector halves or terminals not fully seated in the connector body.

(5) Check for improperly formed or damaged terminals. All connector terminals in a suspect circuit should be carefully reformed to increase contact tension.

(6) Look for poor terminal-to-wire connections. This requires removing the terminal from the connector body to inspect it.

(7) Verify pin presence in the connector assembly

(8) Check for proper ground connections. Check all ground connections for signs of corrosion, loose fasteners, or other potential defects. Refer to the wiring diagrams for ground locations.

(9) Look for problems with the main power sources of the vehicle. Inspect the battery, generator, ignition circuits and other related relays and fuses.

If a visual check does not find the cause of the problem, operate the car in an attempt to duplicate the condition and record any trouble codes.

Most failures of the ABS disable the ABS function for the entire ignition cycle even if the fault clears before key-off. There are some failure conditions, however, that allow ABS operation to resume during the ignition cycle in which the trouble occurred even if the trouble conditions are no longer present.

The following trouble conditions may result in intermittent illumination of the amber ABS warning lamp.

- Low system voltage. If Low System Voltage is detected by the CAB, the CAB will turn on the ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is seen at the CAB, normal operation resumes.

- High system voltage. If high system voltage is detected by the CAB, the CAB will turn on the

DIAGNOSIS AND TESTING (Continued)

Amber ABS Warning Lamp until normal system voltage is achieved. Once normal voltage is again detected by the CAB, normal ABS operation resumes.

Additional possible causes that may result in the illumination of the amber ABS warning lamp are as follows:

- Any condition that interrupts electrical current to the CAB may cause the amber ABS warning lamp to turn on intermittently.
- If CCD communication between the body controller and the CAB is interrupted, the body controller can turn on the amber ABS warning lamp.

TRACTION CONTROL LAMP

The traction control lamp is tested by cycling the traction control switch on and off. The traction control switch used on this vehicle is a momentary contact type switch. The test procedure for the traction control light is performed as follows: Press the traction control switch once and the TRAC OFF lamp will illuminate. With the TRAC OFF lamp illuminated, press the traction control switch again and the TRAC OFF lamp will turn off.

If the traction control lamp does not function as described in the test above, diagnosis of the traction control switch, lamp, wiring and other related components of the traction control system is required.

TONE WHEEL

Tone wheels can cause erratic wheel speed sensor signals. Inspect tone wheels for the following possible causes.

- missing, chipped, or broken teeth
- contact with the wheel speed sensor
- wheel speed sensor to tone wheel alignment
- wheel speed sensor to tone wheel clearance
- excessive tone wheel runout
- tone wheel loose on its mounting surface

If a front tone wheel is found to need replacement, the drive shaft must be replaced. No attempt should be made to replace just the tone wheel. Refer to the DIFFERENTIAL AND DRIVELINE group in this service manual for removal and installation.

If a rear tone wheel is found to need replacement on front-wheel-drive models, the tone wheel is serviceable separately. Refer to TONE WHEEL in the REMOVAL AND INSTALLATION section.

If a rear tone wheel is found to need replacement on all-wheel-drive models, the drive shaft must be replaced. No attempt should be made to replace just the tone wheel. Refer to the DIFFERENTIAL AND DRIVELINE group in this service manual for removal and installation.

If wheel speed sensor to tone wheel contact is evident, determine the cause and correct it before replacing the wheel speed sensor or tone wheel.

Check the gap between the speed sensor head and the tone wheel to ensure it is within specifications. Refer to SPECIFICATIONS in this section of the service manual for the minimum and maximum wheel speed sensor to tone wheel clearance.

Excessive wheel speed sensor runout can cause erratic wheel speed sensor signals. Refer to SPECIFICATIONS in this section of the service manual for the maximum allowed tone wheel runout. If tone wheel runout is excessive, determine if it is caused by a defect in the driveshaft assembly or hub and bearing. Replace as necessary.

Tone wheels are pressed onto their mounting surfaces and should not rotate independently from the mounting surface. Replacement of the front driveshaft or rear hub and bearing is necessary.

PROPORTIONING VALVE

A vehicle equipped with ABS uses a fixed proportioning valve.

On a vehicle equipped with ABS, premature or excessive rear wheel ABS cycling may be an indication that the brake fluid pressure to the rear brakes is above the desired output.

Prior to testing a proportioning valve for function, check that all tire pressures are correct. Also, ensure the front and rear brake linings are in satisfactory condition. **It is also necessary to verify that the brakes shoe assemblies on a vehicle being tested, are either original equipment manufacturers (OEM), or original replacement brake shoe assemblies meeting the OEM lining material specification. The vehicles brake system is not balanced for after market brake shoe assembly lining material.**

If brake shoe assembly lining material is of satisfactory condition, and of the correct material specification, check for proper proportioning valve function using the following procedure.

(1) Road test vehicle to be sure the vehicle is truly exhibiting a condition of excessive rear wheel ABS cycling. Since ABS cycles both rear brakes together **both proportioning valves of the assembly** (Fig. 16) must be tested. Use the following procedure to test the proportioning valve.

(2) Remove one of the chassis brake lines (Fig. 16) coming from the ABS modulator, at

(2) the proportioning valve assembly. Remove the hydraulic brake line going to one of the rear wheels of the vehicle from the proportioning valve (Fig. 16)

(3) Remove the 2 bolts (Fig. 16) attaching the proportioning valve to the frame rail.

CAUTION: When lowering the proportioning valve, care must be taken not to kink any of the chassis brake lines.

DIAGNOSIS AND TESTING (Continued)

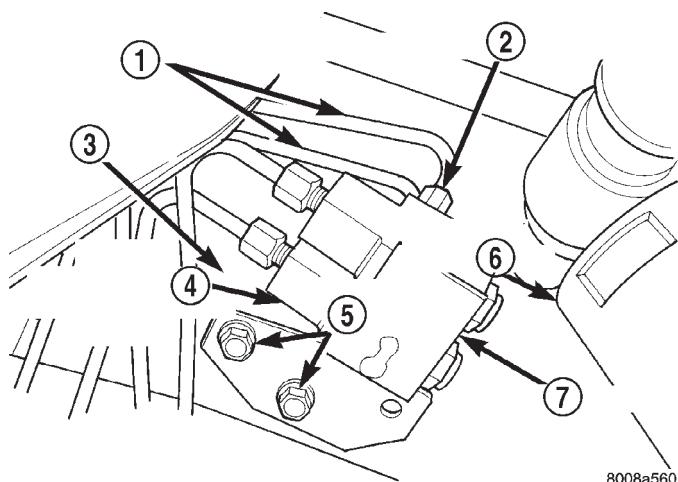


Fig. 16 Rear Brake Proportioning Valve And Brake Tube Locations

- 1 – CHASSIS BRAKE LINES FROM ABS MODULATOR
- 2 – LEFT REAR BRAKE PROPORTIONING VALVE
- 3 – LEFT REAR FRAME RAIL
- 4 – RIGHT REAR BRAKE PROPORTIONING VALVE
- 5 – ATTACHING BOLTS
- 6 – SHOCK ABSORBER
- 7 – PROPORTIONING VALVE ASSEMBLY

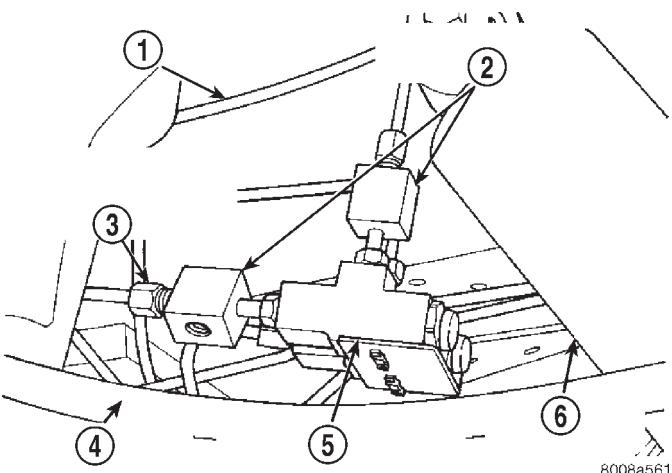


Fig. 17 Proportioning Valve Test Fitting Installation

- 1 – CHASSIS BRAKE LINE FROM ABS MODULATOR
- 2 – SPECIAL TOOL 6833
- 3 – CHASSIS BRAKE LINE TO REAR BRAKE
- 4 – PARK BRAKE CABLE
- 5 – PROPORTIONING VALVE ASSEMBLY
- 6 – SHOCK ABSORBER

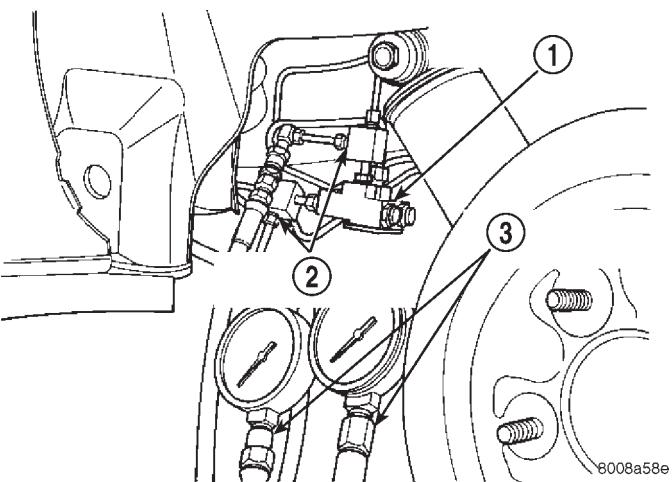


Fig. 18 Pressure Gauges Installed On Pressure Test Fittings

- 1 – PROPORTIONING VALVE ASSEMBLY
- 2 – PRESSURE TEST FITTINGS
- 3 – SPECIAL TOOL C-4007-A

specification when required inlet pressure is obtained, replace the proportioning valve.

(8) Repeat steps 2 through 7 for the other proportioning valve of the assembly.

CAUTION: When mounting the original or a replacement proportion valve on the frame rail of the vehicle install the mounting bolts in only the two forward holes of the mounting bracket (Fig. 16). Proportioning valve split point pressure conversion is 1 bar is equal to 14.5 psi.

(4) Carefully lower the proportioning valve for clearance to install the proportioning valve test fittings.

(5) Install the required fitting from Pressure Test Fittings, Special Tool 6833 (Fig. 17) into the inlet port of the proportioning valve assembly, from which the chassis brake line was removed. Install the removed chassis brake line into the Pressure Test Fitting (Fig. 17). Install the required fitting from Pressure Test Fittings, Special Tool 6833 into the required outlet port of the proportioning valve. Install the required fitting from Pressure Test Fittings, Special Tool 6833 into the required outlet port of the proportioning valve (Fig. 17). Then install the removed chassis brake line into the Pressure Test Fitting (Fig. 17).

(6) Install a pressure gauge from Gauge Set, Special Tool C-4007-A into each pressure test fitting (Fig. 18). Bleed air out of hose from pressure test fittings to pressure gauges, at the pressure gauges (Fig. 18). Then bleed air out of the brake line being tested, at that rear wheel cylinder.

(7) With the aid of a helper, apply pressure to the brake pedal until a pressure of 6895 kPa (1000 psi) is obtained on the proportioning valve inlet gauge. Then based on the type of brake system the vehicle is equipped with and the pressure specification shown on the following table, compare the pressure reading on the outlet gauge to the specification. If outlet pressure at the proportioning valve is not within

DIAGNOSIS AND TESTING (Continued)

WHEEL BASE	DRIVE TRAIN	SALES CODE	BRAKE SYSTEM	SPLIT POINT	SLOPE	INLET PRESSURE PSI	OUTLET PRESSURE PSI
SWB	FWD	BRA-BGF	14" DISC/DRUM W/O ANTILOCK	VAR.	.30	1000 PSI	250-350 PSI
SWB	FWD	BRA+BGF BRB+BGF BRV+BGF	14",15",15"HD DISC/DRUM WITH ANTILOCK	25 BAR	.59	1000 PSI	660-780 PSI
LWB	FWD	BRA-BGF	14" DISC/DRUM W/O ANTILOCK	VAR.	.30	1000 PSI	250-350 PSI
LWB	FWD	BRA+BGF BRB+BGF BRV+BGF	14",15",15"HD DISC/DRUM WITH ANTILOCK	25 BAR	.59	1000 PSI	660-780 PSI
LWB	AWD	BRE+BGF	15" DISC/DISC WITH ANTILOCK	41 BAR	.36	1000 PSI	690-800 PSI

BRAKE FLUID CONTAMINATION

Indications of fluid contamination are swollen or deteriorated rubber parts. Swelling indicates the presence of petroleum in the brake fluid.

To test for contamination, put a small amount of drained brake fluid in clear glass jar. If the fluid separates into layers, there is mineral oil or other fluid contamination of the brake fluid.

If the brake fluid is contaminated, drain and thoroughly flush the brake system. Replace all the rubber parts or components containing rubber coming into contact with the brake fluid including: the master cylinder; proportioning valves; caliper seals; wheel cylinder seals; ABS hydraulic control unit; and all hydraulic fluid hoses.

SERVICE PROCEDURES**BRAKE FLUID LEVEL CHECKING**

CAUTION: Use only Mopar brake fluid or an equivalent from a tightly sealed container. Brake fluid must conform to DOT 3 specifications. Do not use petroleum-based fluid because seal damage in the brake system will result.

Refer to SERVICE PROCEDURES in the BASE BRAKE SYSTEM section in this group for the proper procedure to check and adjust the brake fluid level in the master cylinder fluid reservoir.

ANTILOCK BRAKE SYSTEM BLEEDING

The base brake's hydraulic system must be bled anytime air enters the hydraulic system. The ABS though, particularly the ICU (HCU), should only be bled when the HCU is replaced or removed from the vehicle. The ABS must always be bled anytime it is

suspected that the HCU has ingested air. Under most circumstances that require the bleeding of the brakes hydraulic system, only the base brake hydraulic system needs to be bled.

It is important to note that excessive air in the brake system will cause a soft or spongy feeling brake pedal.

During the brake bleeding procedure, be sure the brake fluid level remains close to the FULL level in the master cylinder fluid reservoir. Check the fluid level periodically during the bleeding procedure and add DOT 3 brake fluid as required.

The ABS must be bled as two independent braking systems. The non-ABS portion of the brake system with ABS is to be bled the same as any non-ABS system.

The ABS portion of the brake system must be bled separately. Use the following procedure to properly bleed the brake hydraulic system including the ABS.

BLEEDING

When bleeding the ABS system, the following bleeding sequence must be followed to insure complete and adequate bleeding.

(1) Make sure all hydraulic fluid lines are installed and properly torqued.

(2) Connect the DRB scan tool to the diagnostics connector. The diagnostic connector is located under the lower steering column cover to the left of the steering column.

(3) Using the DRB, check to make sure the CAB does not have any fault codes stored. If it does, clear them using the DRB.

SERVICE PROCEDURES (Continued)

WARNING: WHEN BLEEDING THE BRAKE SYSTEM WEAR SAFETY GLASSES. A CLEAR BLEED TUBE MUST BE ATTACHED TO THE BLEEDER SCREWS AND SUBMERGED IN A CLEAR CONTAINER FILLED PART WAY WITH CLEAN BRAKE FLUID. DIRECT THE FLOW OF BRAKE FLUID AWAY FROM YOURSELF AND THE PAINTED SURFACES OF THE VEHICLE. BRAKE FLUID AT HIGH PRESSURE MAY COME OUT OF THE BLEEDER SCREWS WHEN OPENED.

(4) Bleed the base brake system using the standard pressure or manual bleeding procedure as outlined in SERVICE PROCEDURES in the BASE BRAKE SYSTEM section at the beginning of this group.

(5) Using the DRB, select ANTILOCK BRAKES, followed by MISCELLANEOUS, then BLEED BRAKES. Follow the instructions displayed. When the scan tool displays TEST COMPLETED, disconnect the scan tool and proceed.

(6) Bleed the base brake system a second time. Check brake fluid level in the reservoir periodically to prevent emptying, causing air to enter the hydraulic system.

(7) Fill the master cylinder reservoir to the full level.

(8) Test drive the vehicle to be sure the brakes are operating correctly and that the brake pedal does not feel spongy.

REMOVAL AND INSTALLATION

SERVICE WARNINGS AND CAUTIONS

Review this entire section prior to performing any mechanical work on a vehicle equipped with ABS. This section contains information on precautions pertaining to potential component damage, vehicle damage and personal injury which could result when servicing an ABS equipped vehicle.

CAUTION: Only the recommended jacking or hoisting positions for this vehicle are to be used whenever it is necessary to lift a vehicle. Failure to raise a vehicle from the recommended locations could result in lifting a vehicle by the hydraulic control unit mounting bracket. Lifting a vehicle by the hydraulic control unit mounting bracket will result in damage to the mounting bracket and the hydraulic control unit.

CAUTION: An attempt to remove or disconnect certain system components may result in improper system operation. Only those components with

approved removal and installation procedures in this manual should be serviced.

CAUTION: Brake fluid will damage painted surfaces. If brake fluid is spilled on any painted surfaces, wash off with water immediately.

CAUTION: When performing any service procedure on a vehicle equipped with ABS do not apply a 12-volt power source to the ground circuit of the pump motor in the HCU. Doing this will damage the pump motor and will require replacement of the entire HCU.

CAUTION: If welding work is to be performed on the vehicle, using an electric arc welder, the CAB connector should be disconnected during the welding operation.

CAUTION: The CAB 25-way connector should never be connected or disconnected with the ignition switch in the ON position.

Many components of the ABS System are not serviceable and must be replaced as an assembly. Do not disassemble any component which is not designed to be serviced.

INTEGRATED CONTROL UNIT

NOTE: Before proceeding, review all SERVICE WARNINGS AND CAUTIONS at the beginning of the REMOVAL AND INSTALLATION section.

REMOVAL

(1) Disconnect the negative (ground) cable from the battery and isolate cable.

(2) Using a brake pedal depressor, move and lock the brake pedal to a position past the first inch of pedal travel. **This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the HCU.**

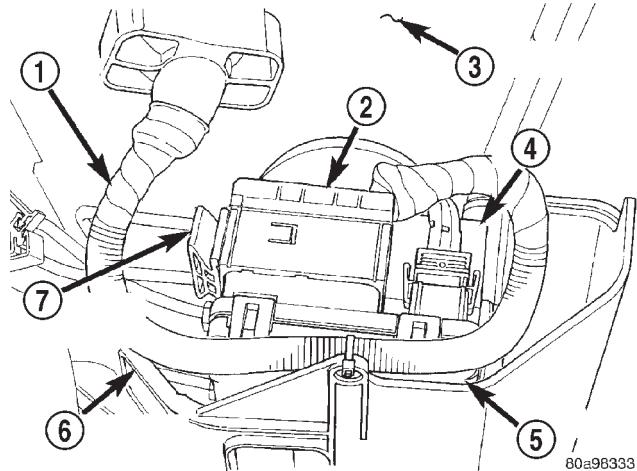
(3) Raise vehicle. Vehicle is to be raised and supported on jackstands or on a frame contact type hoist. See Hoisting in the Lubrication And Maintenance section of this service manual.

(4) Remove the routing clip attaching the ICU wiring harness to the ICU mounting bracket (Fig. 19).

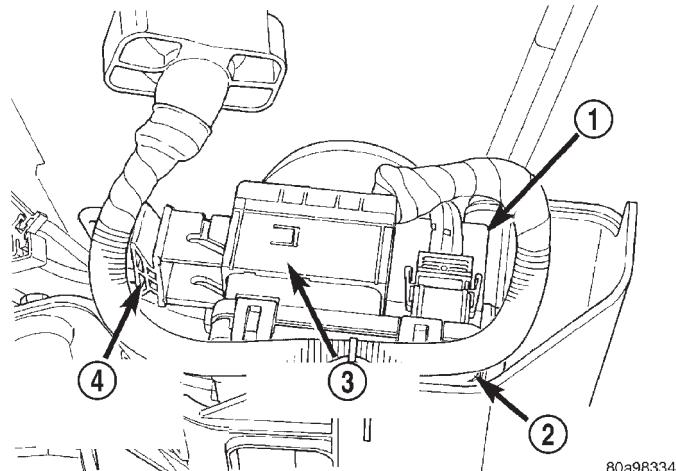
CAUTION: Do not apply a 12 volt power source to any terminals of the 25 way HCU connector when disconnected.

REMOVAL AND INSTALLATION (Continued)

(5) Remove the 25 way connector (Fig. 19) from the CAB. The 25 way connector is removed from the CAB using the following procedure. Grasp the lock on the 25 way connector (Fig. 19) and pull it as far out as possible (Fig. 20). This will raise and unlock the 25 way connector from the socket on the CAB.

**Fig. 19 CAB 25 Way Connector**

- 1 - CAB WIRING HARNESS
- 2 - 25-WAY CONNECTOR
- 3 - FLOOR PAN
- 4 - HCU
- 5 - CAB
- 6 - HCU MOUNTING BRACKET
- 7 - CONNECTOR LOCK

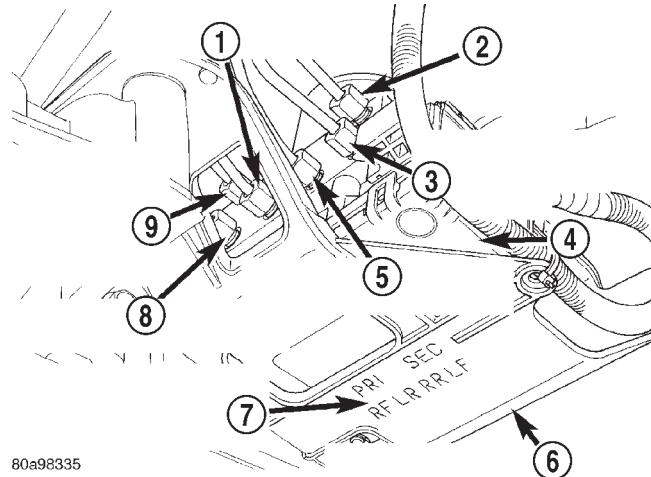
**Fig. 20 Unlocked 25 Way CAB Connector**

- 1 - HCU
- 2 - CAB
- 3 - 25-WAY CONNECTOR
- 4 - CONNECTOR LOCK (UNLOCKED)

CAUTION: Before removing the brake tubes from the HCU, the HCU must be thoroughly cleaned. This must be done to prevent dirt particles from falling into the ports of HCU or entering the brake tubes.

(6) Thoroughly clean all surfaces of the HCU, and all brake tube nuts located on the HCU. Use only a solvent such as Mopar Brake Parts Cleaner or an equivalent to clean the HCU.

(7) Remove the brake tubes (6) from the inlet and outlet ports on the HCU. (Fig. 21).

**Fig. 21 Brake Tube Connections To HCU**

- 1 - LEFT REAR WHEEL BRAKE TUBE
- 2 - SECONDARY BRAKE TUBE FROM MASTER CYLINDER
- 3 - LEFT FRONT WHEEL BRAKE TUBE
- 4 - CAB
- 5 - RIGHT REAR WHEEL BRAKE TUBE
- 6 - HCU MOUNTING BRACKET
- 7 - BRAKE TUBE TO HCU CONNECTION LOCATION LEGEND
- 8 - RIGHT FRONT WHEEL BRAKE TUBE
- 9 - PRIMARY BRAKE TUBE FROM MASTER CYLINDER

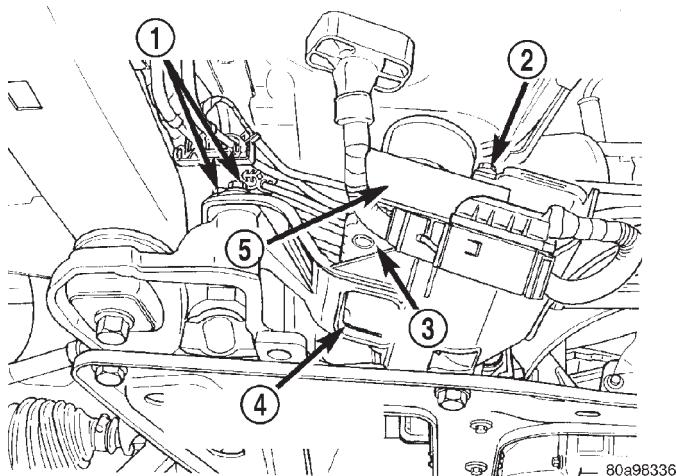
(8) Remove the 3 bolts (Fig. 22) attaching the ICU mounting bracket to the front suspension crossmember.

(9) Remove ICU and the mounting bracket as a unit from the vehicle.

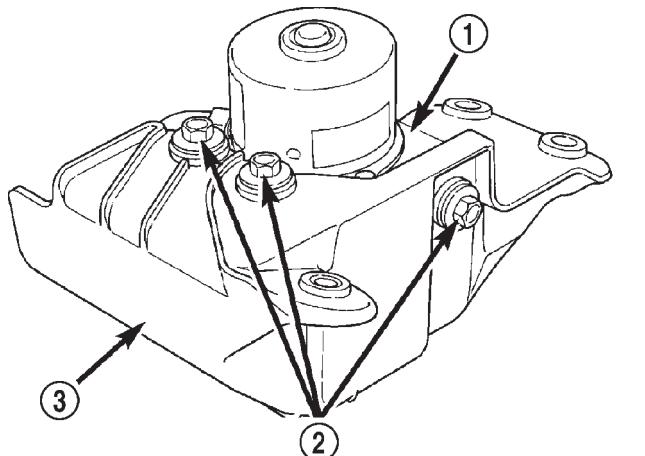
(10) Remove the 3 bolts (Fig. 23) mounting the ICU to the mounting bracket. Separate the ICU from the mounting bracket.

(11) Refer to DISASSEMBLY AND ASSEMBLY in this section for the procedure on separating and attaching the CAB to the HCU.

REMOVAL AND INSTALLATION (Continued)

**Fig. 22 ICU To Suspension Cradle Mounting Bolts**

- 1 - HCU MOUNTING BRACKET BOLTS
 2 - HCU MOUNTING BRACKET BOLT
 3 - CAB
 4 - HCU MOUNTING BRACKET
 5 - HCU

**Fig. 23 ICU Mounting Bolts**

- 1 - HCU
 2 - HCU MOUNTING BOLTS
 3 - HCU MOUNTING BRACKET

INSTALLATION

(1) Install the ICU on the mounting bracket (Fig. 23). Install the 3 bolts (Fig. 23) attaching the ICU to the mounting bracket. Tighten the 3 mounting bolts to a torque of 11 N·m (97 in. lbs.).

CAUTION: The ICU mounting bracket to front suspension cradle mounting bolts have a unique corrosion protection coating and a special aluminum washer. For this reason, only the original, or original equipment Mopar replacement bolts can be used to mount the ICU bracket to the front suspension crossmember.

(2) Install the ICU and its mounting bracket as an assembly on the front suspension crossmember. Install the 3 bolts attaching the ICU bracket to the crossmember (Fig. 22). Tighten the 3 mounting bolts to a torque of 28 N·m (250 in. lbs.).

CAUTION: Because of the flexible section in the primary and secondary brake tubes, and the brake tubes between the HCU and the proportioning valve, the brake tubes must be held in proper orientation when tightened and torqued. These tubes must not contact each other or other vehicle components when installed. Also, after the brake tubes are installed on the HCU, ensure all spacer clips are reinstalled on the brake tubes.

CAUTION: When installing the chassis brake tubes on the HCU valve block, they must be located correctly in the valve block to ensure proper ABS operation. Refer to (Fig. 21) for the correct chassis brake tube locations.

NOTE: The chassis brake tube attachment locations to the HCU, are marked on the bottom of the ICU mounting bracket.

(3) Install the 6 chassis brake tubes into their correct port locations on the HCU valve block as shown in (Fig. 21). Tighten the tube nuts to a torque of 17 N·m (145 in. lbs.).

NOTE: Before installing the 25 way connector in the CAB be sure the seal is properly installed in the connector.

(4) Install the 25 way connector (Fig. 19) on the CAB using the following procedure. Position the 25 way connector in the socket of the CAB and carefully push it down as far as possible. When connector is fully seated by hand into the CAB socket, push in the connector lock (Fig. 20). This will pull the connector into the socket of the CAB and lock it in the installed position.

NOTE: The CAB wiring harness must be clipped to the ICU mounting bracket. This will ensure the wiring harness is properly routed and does not contact the brake tubes or the body of the vehicle.

(5) Clip the cab wiring harness (Fig. 19) to the ICU mounting bracket.

(6) Install the routing clips (Fig. 24) on the brake tubes.

(7) Lower the vehicle.

(8) Connect negative cable back on negative post of the battery.

REMOVAL AND INSTALLATION (Continued)

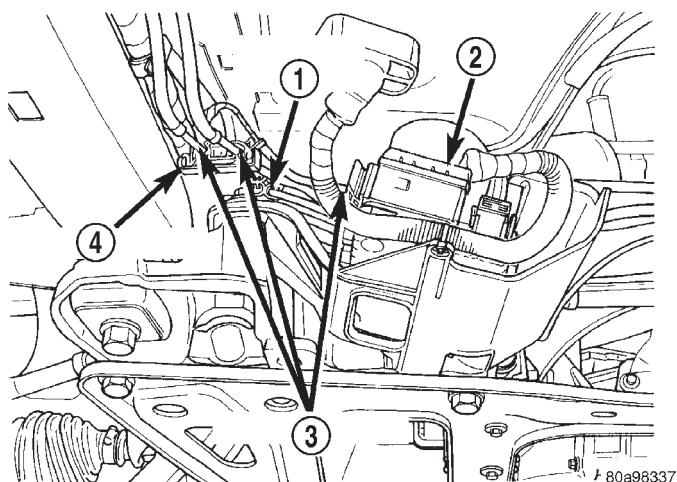


Fig. 24 Brake Tube Routing Clips

- 1 – ROUTING CLIP
- 2 – HCU
- 3 – BRAKE TUBES
- 4 – ROUTING CLIP

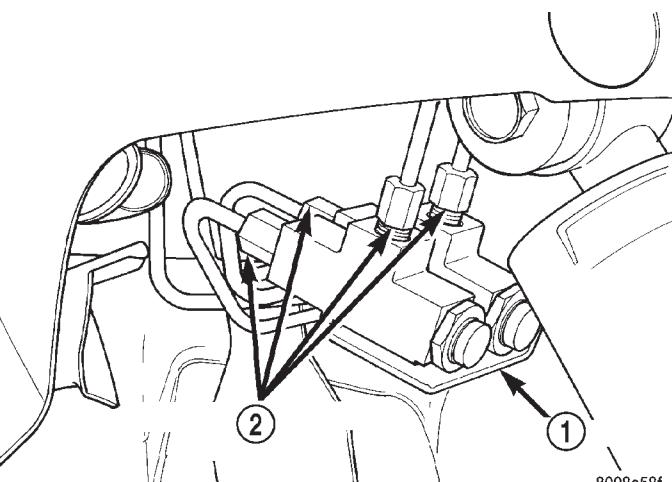


Fig. 25 Chassis Brake Tubes At Proportioning Valve

- 1 – PROPORTIONING VALVE
- 2 – CHASSIS BRAKE TUBES (4)

(9) Bleed the base and ABS hydraulic systems. Refer to ANTILOCK BRAKE SYSTEM BLEEDING in this section for the proper bleeding procedure.

(10) Road test vehicle to ensure proper operation of the base and antilock brake systems.

PROPORTIONING VALVE

The actual proportioning valves of the proportioning valve assembly are not serviceable or replaceable. If a proportioning valve of the proportioning valve assembly is not functioning properly, the fixed proportioning valve (ABS vehicles only) must be replaced as an assembly.

REMOVAL

(1) Using a brake pedal depressor, move and lock the brake pedal to a position past its first 1 inch of travel. This will prevent brake fluid from draining out of the master cylinder when the brake tubes are removed from the proportioning valve.

(2) Raise vehicle on jackstands or centered on a hoist. See Hoisting in the Lubrication And Maintenance Group of this service manual.

CAUTION: Before removing the brake tubes from the proportioning valve, the proportioning valve and the brake tubes must be thoroughly cleaned. This is required to prevent contamination from entering the proportioning valve or the brake tubes.

(3) Remove the 4 chassis brake lines from the inlet and outlet ports of the proportioning valve (Fig. 25).

(4) Remove the bolts (Fig. 26) attaching the proportioning valve bracket to the frame rail of the vehicle. Remove the fixed proportioning valve assembly from the vehicle.

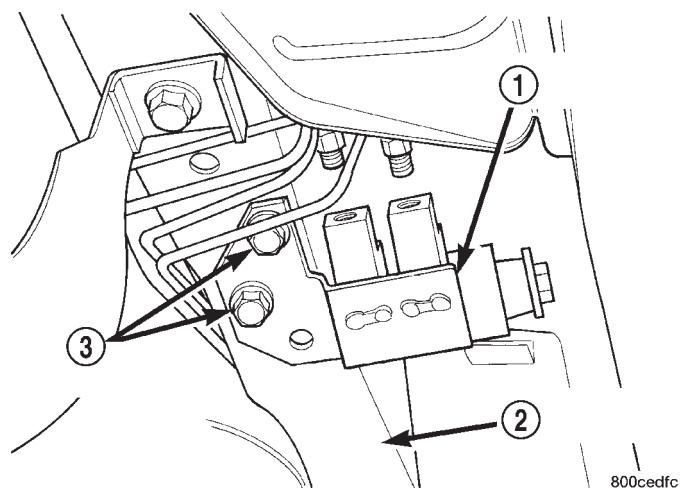


Fig. 26 Proportioning Valve Attachment To Vehicle

- 1 – POSITIONING VALVE ASSEMBLY
- 2 – LEFT REAR FRAME RAIL
- 3 – MOUNTING BOLTS

INSTALLATION

CAUTION: When mounting the original or a replacement proportioning valve on the frame rail of the vehicle install the mounting bolts in only the two forward holes of the mounting bracket (Fig. 26).

(1) Install proportioning valve assembly on the frame rail of the vehicle. Install the proportioning valve assembly attaching bolts (Fig. 26). Tighten the attaching bolts to a torque of 14 N·m (125 in. lbs.).

REMOVAL AND INSTALLATION (Continued)

(2) Install the 4 chassis brake lines (Fig. 25) into the inlet and outlet ports of the proportioning valve assembly. Tighten all 4 line nuts to a torque of 16 N·m (142 in. lbs.).

(3) Bleed the brake system thoroughly enough to ensure that all air has been expelled from the hydraulic system. See Bleeding Brake System in the Service Adjustments section in this group of the service manual for the proper bleeding procedure.

(4) Lower the vehicle to the ground.

(5) Road test the vehicle to verify proper operation of the vehicles brake system.

TONE WHEEL (REAR FWD)

This procedure is for the removal of the ABS rear tone wheel from the rear hub and bearing on front wheel drive vehicles. Vehicles equipped with AWD have a tone wheel mounted on the driveshaft outer constant velocity joint and it is serviced with the driveshaft. Refer to the DIFFERENTIAL AND DRIVELINE service manual group.

REMOVE

(1) Raise vehicle on jackstands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual for required lifting procedure.

(2) Remove the wheel and tire assembly.

(3) Remove rear brake drum from the hub/bearing assembly.

(4) Remove the rear wheel speed sensor from the rear hub/bearing flange (Fig. 27). This will prevent damage to the speed sensor during removal and installation of the hub/bearing assembly.

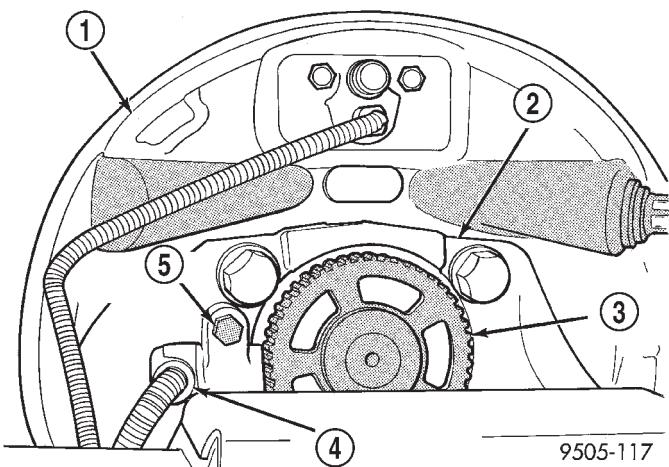


Fig. 27 Rear Wheel Speed Sensor

- 1 - BRAKE SUPPORT PLATE
- 2 - REAR AXLE
- 3 - TONE WHEEL
- 4 - WHEEL SPEED SENSOR
- 5 - MOUNTING BOLT

(5) Remove the 4 bolts (Fig. 28) attaching the hub/bearing assembly to the flange of the rear axle.

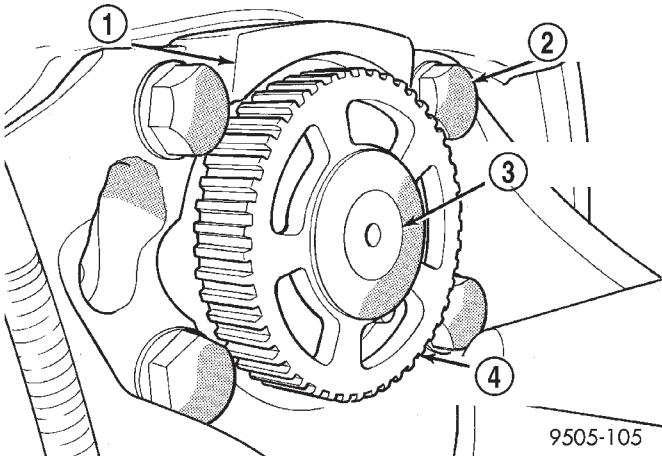


Fig. 28 Rear Hub/Bearing Mounting Bolts

- 1 - REAR AXLE FLANGE
- 2 - HUB/BEARING MOUNTING BOLTS (4)
- 3 - HUB/BEARING ASSEMBLY
- 4 - TONE WHEEL (WHEN ABS EQUIPPED)

(6) Remove the hub/bearing assembly from the rear axle and brake support plate (Fig. 29).

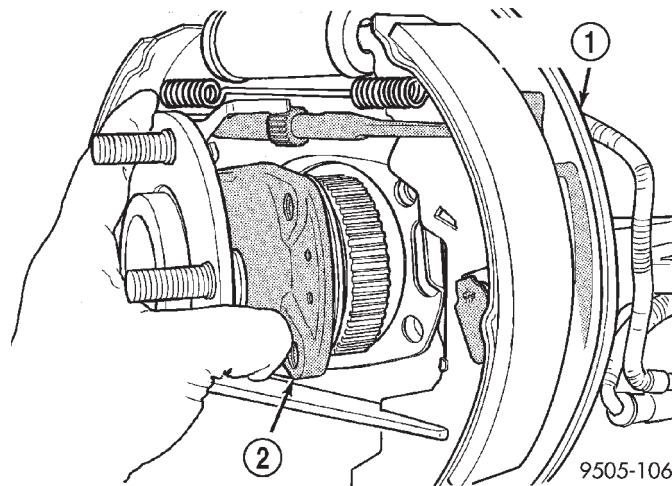


Fig. 29 Removing Rear Hub/Bearing From Axle

- 1 - BRAKE SUPPORT PLATE
- 2 - HUB/BEARING ASSEMBLY

(7) Install wheel lug nuts on 3 of the wheel mounting studs to protect the stud threads from damage by the vise jaws. Mount the hub/bearing assembly in a vise (Fig. 30). Using Puller, Special Tool C-4693 installed as shown in (Fig. 30) remove the tone wheel from the hub/bearing assembly.

INSTALL

(1) Place hub/bearing assembly in an arbor press supported by Receiver, Special Tool, 6062A-3 (Fig.

REMOVAL AND INSTALLATION (Continued)

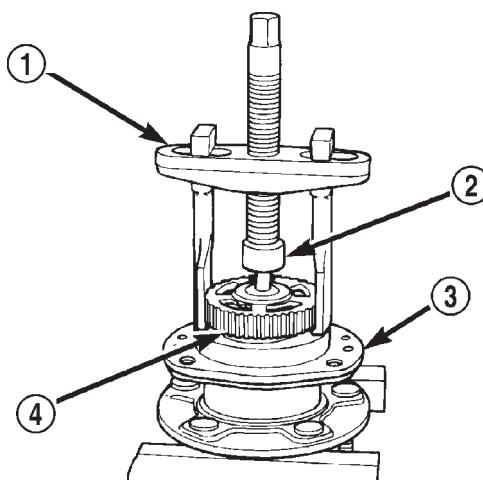


Fig. 30 Tone Wheel Removal From Hub/Bearing Assembly

- 1 – SPECIAL TOOL C-4693
- 2 – REMOVER BUTTON
- 3 – HUB/BEARING ASSEMBLY
- 4 – TONE WHEEL

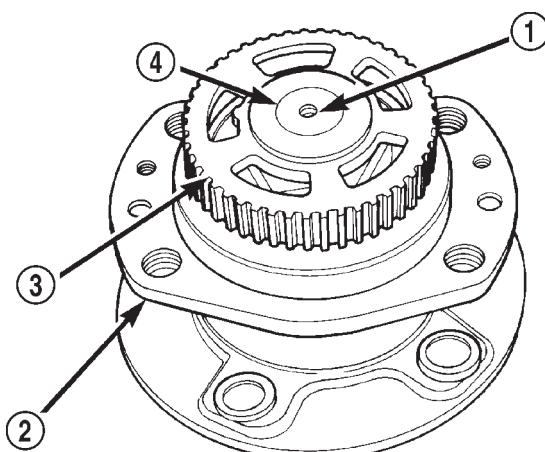


Fig. 32 Correctly Installed Tone Wheel

- 1 – HUB SHAFT
- 2 – HUB/BEARING ASSEMBLY
- 3 – TONE WHEEL
- 4 – TONE WHEEL TO BE INSTALLED FLUSH WITH HUB SHAFT HERE

31). Position Driver, Special Tool 6908-1 with undercut side facing up (Fig. 31) on top of the tone wheel.

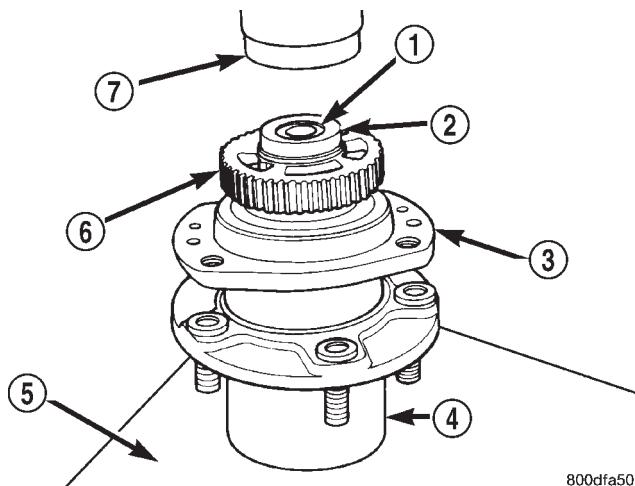


Fig. 31 Installing Tone Wheel On Hub/Bearing Assembly

- 1 – UNDERCUT
- 2 – SPECIAL TOOL 6908-1
- 3 – HUB/BEARING ASSEMBLY
- 4 – SPECIAL TOOL 6062-A
- 5 – ARBOR PRESS BED
- 6 – TONE WHEEL
- 7 – ARBOR PRESS RAM

(2) Press the tone wheel onto the hub/bearing assembly until it is flush with the end of hub shaft (Fig. 32).

(3) Install the 4 hub/bearing to axle flange mounting bolts into the 4 mounting holes in the flange of the rear axle.

(4) Install the rear brake support plate on the 4 mounting bolts installed in the flange of the rear axle.

(5) Align the rear hub/bearing assembly with the 4 mounting bolts and start mounting bolts into hub/bearing assembly. Tighten the 4 bolts in a criss-cross pattern until the hub/bearing and brake support plate is fully and squarely seated onto flange of rear axle.

(6) Tighten the 4 hub/bearing mounting bolts (Fig. 28) to a torque of 129 N·m (95 ft. lbs.)

(7) Install the rear wheel speed sensor on the rear hub/bearing flange (Fig. 27). Install the speed sensor attaching bolt and tighten to a torque of 12 N·m (105 in. lbs.).

(8) Check the air gap between the face of the wheel speed sensor and the top surface of the tone wheel. Air gap must be less than the maximum allowable tolerance of 1.2 mm (.047 in.).

(9) Install the brake drum onto the rear hub/bearing assembly.

(10) Install rear wheel and tire assembly, tighten wheel stud nuts to 129 N·m (95 ft. lbs.).

(11) Adjust the rear brakes, (See Adjusting Service Brakes) in Service Adjustments section in this group of the service manual.

REMOVAL AND INSTALLATION (Continued)

WHEEL SPEED SENSOR (FRONT)

REMOVE

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this service manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

(3) Remove the 2 screws (Fig. 33) attaching front channel bracket and grommet retainer to the outer frame rail.

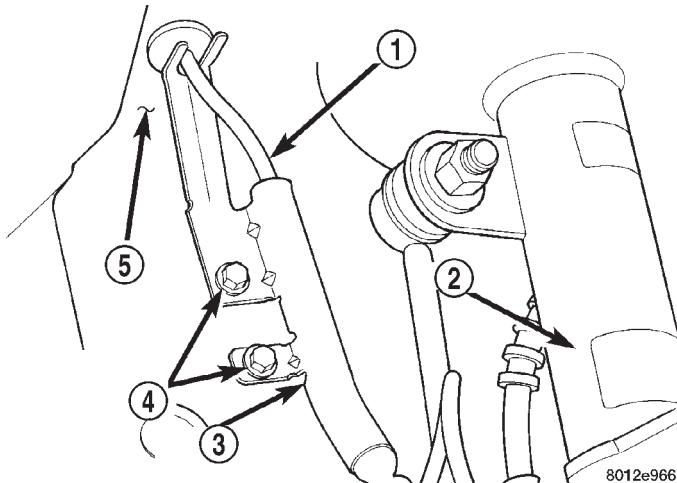


Fig. 33 Front Speed Sensor Cable Channel Bracket

- 1 – WHEEL SPEED SENSOR CABLE
- 2 – STRUT
- 3 – CHANNEL BRACKET
- 4 – ATTACHING SCREWS
- 5 – STRUT TOWER

CAUTION: When disconnecting the wheel speed sensor from vehicle wiring harness, be careful not to damage pins on connector

(4) Pull speed sensor cable grommet and connector through the hole in the strut tower (Fig. 34). Disconnect speed sensor cable from vehicle wiring harness (Fig. 34).

(5) Remove the wheel speed sensor head to steering knuckle attaching bolt (Fig. 35).

(6) Remove sensor head from steering knuckle. If the sensor has seized, due to corrosion, **DO NOT USE PLIERS ON SENSOR HEAD**. Use a hammer and a punch and tap edge of sensor ear, rocking the sensor side to side until free.

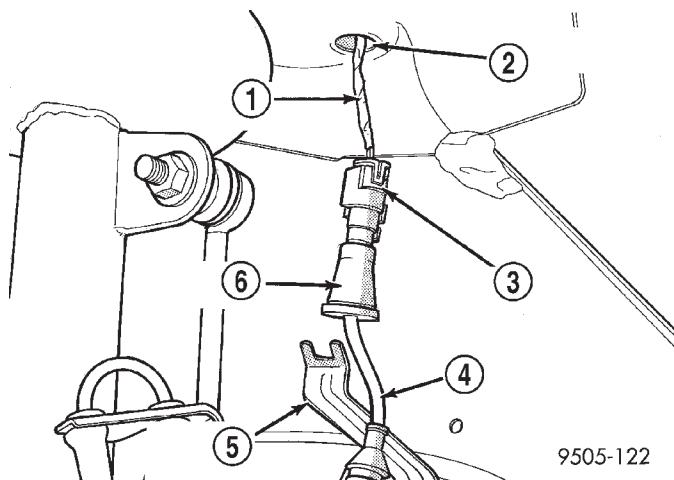


Fig. 34 Speed Sensor Cable To Vehicle Wiring Harness

- 1 – VEHICLE WIRING HARNESS
- 2 – STRUT TOWER HOLE
- 3 – CONNECTOR
- 4 – WHEEL SPEED SENSOR CABLE
- 5 – CHANNEL BRACKET
- 6 – SEALING GROMMET

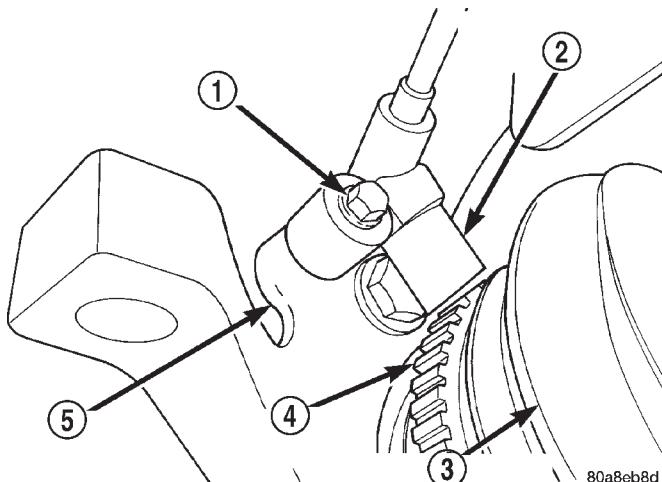


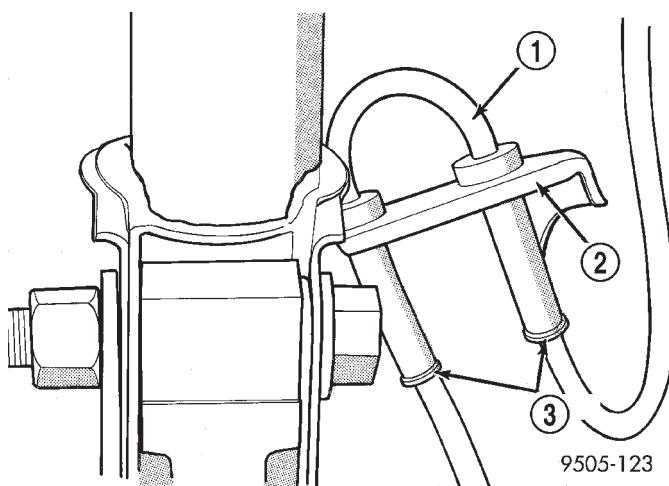
Fig. 35 Front Wheel Speed Sensor Attaching Bolt

- 1 – MOUNTING BOLT
- 2 – WHEEL SPEED SENSOR
- 3 – DRIVESHAFT
- 4 – TONE WHEEL
- 5 – STEERING KNUCKLE

(7) Remove the wheel speed sensor cable grommets from the retaining bracket (Fig. 36).

(8) Remove front wheel speed sensor assembly from the vehicle.

REMOVAL AND INSTALLATION (Continued)

**Fig. 36 Front Wheel Speed Sensor Cable Routing**

- 1 – SPEED SENSOR CABLE
 2 – BRACKET
 3 – GROMMETS

INSTALL

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Connect the front wheel speed sensor cable to the vehicle wiring harness connector (Fig. 34). Be sure speed sensor cable connector is fully seated and locked into vehicle wiring harness connector, then insert cable and grommet into hole in strut tower (Fig. 34).

CAUTION: When installing channel bracket, do not pinch the speed sensor cable under the channel bracket.

(2) Install the channel bracket and grommet retainer on the frame rail (Fig. 33).

(3) Install the 2 bolts (Fig. 33) attaching the channel bracket to frame. Tighten the 2 attaching bolts to a torque of 11 N·m (95 in. lbs.).

(4) Insert speed sensor cable grommets into intermediate bracket on strut (Fig. 36). Route cable from strut to steering knuckle on the rearward side of the stabilizer bar link.

(5) Install the wheel speed sensor to steering knuckle attaching bolt (Fig. 35). Tighten the speed sensor attaching bolt to a torque of 12 N·m (105 in. lbs.)

(6) Check the air gap between the face of the wheel speed sensor and the top surface of the tone-

wheel. Air gap must be less than the maximum allowable tolerance of 1.2 mm (.047 in.).

(7) Install the wheel and tire assembly on vehicle.

(8) Road test vehicle to ensure proper operation of the base and ABS brake systems.

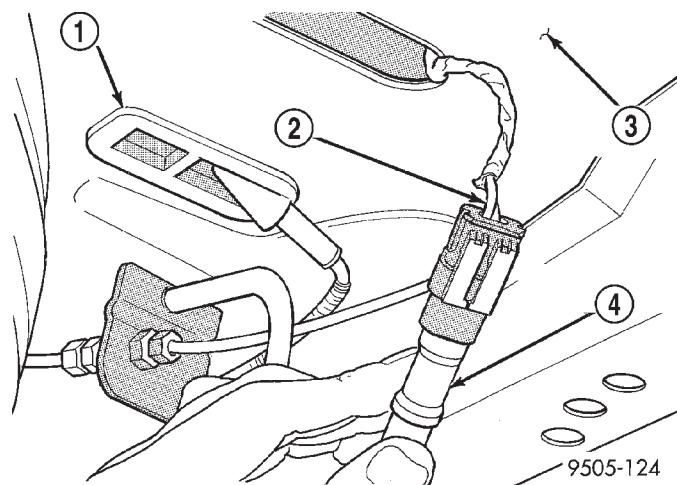
WHEEL SPEED SENSOR (REAR FWD)**REMOVE**

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

CAUTION: When unplugging speed sensor cable from vehicle wiring harness be careful not to damage pins on the electrical connectors. Also inspect connectors for any signs of previous damage.

(3) Remove grommet from floor pan of vehicle and unplug speed sensor cable connector from vehicle wiring harness (Fig. 37).

**Fig. 37 Rear Speed Sensor Cable Connection To Vehicle Wiring Harness**

- 1 – GROMMET
 2 – VEHICLE WIRING HARNESS
 3 – FLOOR PAN
 4 – SPEED SENSOR CABLE

CAUTION: When removing rear wheel speed sensor cable from routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during removal of the speed sensor cable.

REMOVAL AND INSTALLATION (Continued)

(4) Carefully remove the speed sensor cable from the rear brake flex hose routing clips (Fig. 38).

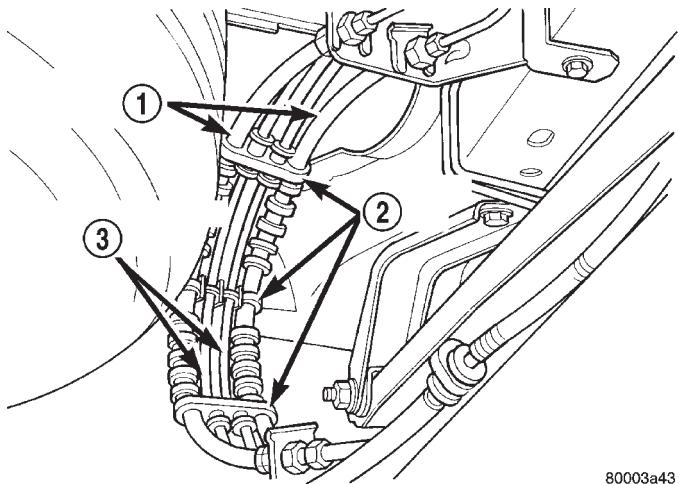


Fig. 38 Speed Sensor Cable Attachment To Brake Flex Hose

- 1 – BRAKE FLEX HOSES
- 2 – ROUTING CLIPS
- 3 – SPEED SENSOR CABLES

(5) If removing the right rear speed sensor cable, remove the speed sensor cable grommet from the axle flange, the brake tube clip and the routing clip from the track bar bracket on the axle (Fig. 39).

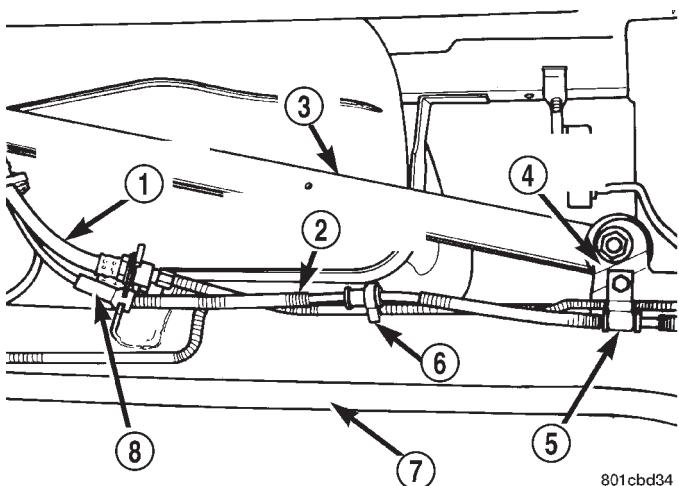


Fig. 39 Right Rear Speed Sensor Cable Routing

- 1 – BRAKE FLEX HOSES
- 2 – RIGHT SPEED SENSOR CABLE
- 3 – TRACK BAR
- 4 – TRACK BAR BRACKET
- 5 – ROUTING CLIP
- 6 – CLIP
- 7 – REAR AXLE
- 8 – SPEED SENSOR CABLE GROMMET

(6) Remove the 2 rear wheel speed sensor cable/brake tube routing clips (Fig. 40). Then un-clip the speed sensor cable from the routing clips on rear brake tube (Fig. 40).

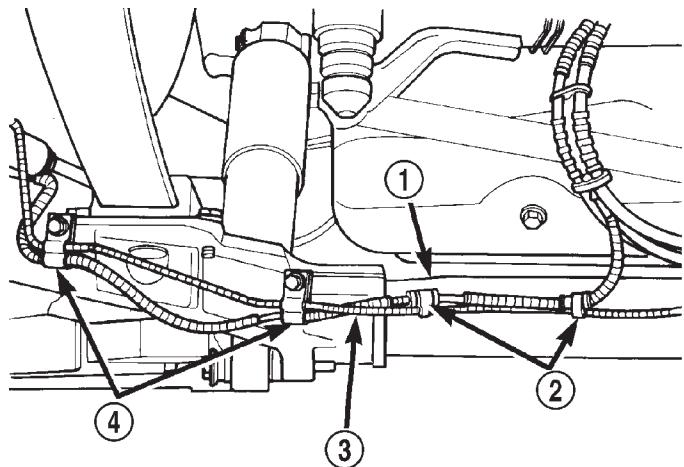


Fig. 40 Rear Speed Sensor Routing Brackets And Clips

- 1 – REAR AXLE
- 2 – SPEED SENSOR TO BRAKE TUBE ROUTING CLIPS
- 3 – REAR AXLE BRAKE TUBE
- 4 – SPEED SENSOR CABLE ROUTING BRACKETS

CAUTION: If the speed sensor has seized, due to corrosion, do not use pliers on speed sensor head in a attempt to remove it. Use a hammer and a punch and tap edge of sensor, rocking the sensor from side to side until free.

(7) Remove the wheel speed sensor head to rear bearing attaching bolt (Fig. 41). If sensor head does not come loose, do not use pliers. Tap with screw driver and hammer.

(8) Remove the wheel speed sensor head from the rear bearing assembly.

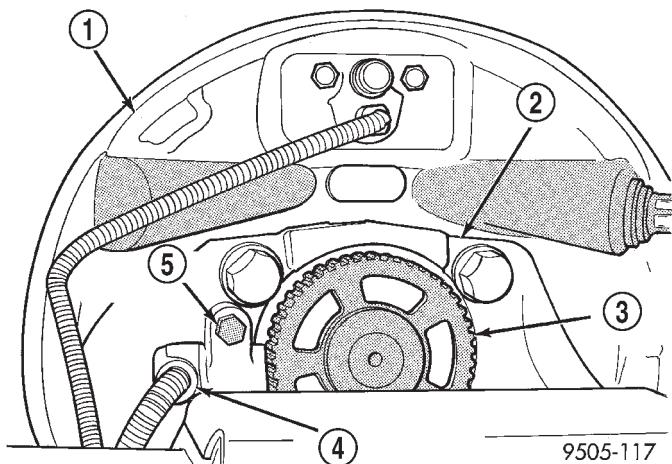
(9) Remove speed sensor assembly from vehicle.

INSTALL

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

(1) Install wheel speed sensor head. Note, the plastic anti rotation pin must be fully seated prior to installing the attaching bolt.

REMOVAL AND INSTALLATION (Continued)

**Fig. 41 Rear Wheel Speed Sensor Attaching Bolt**

- 1 – BRAKE SUPPORT PLATE
 2 – REAR AXLE
 3 – TONE WHEEL
 4 – WHEEL SPEED SENSOR
 5 – MOUNTING BOLT

CAUTION: Prior to installing the speed sensor head attaching bolt, the plastic anti-rotation pin must be fully seated into the bearing flange.

(2) Install the wheel speed sensor head to bearing flange attaching bolt (Fig. 41). Tighten the attaching bolt to a torque 12 N·m (105 in. lbs.)

(3) Check the air gap between the face of the wheel speed sensor and the top surface of the tone-wheel. Air gap must be less than the maximum allowable tolerance of 1.2 mm (.047 in.).

(4) Install the 2 routing brackets attaching the speed sensor cable and brake tube to the rear axle (Fig. 40). **The rear wheel speed sensor cable should be routed under the rear brake tube (Fig. 40).**

CAUTION: When installing rear wheel speed sensor cable in the routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during installation of the wheel speed sensor cable.

(5) Install speed sensor cable into routing clips on rear brake flex hose (Fig. 40).

(6) If installing a right rear speed sensor cable, install the speed sensor cable grommet on the axle brake flex hose bracket (Fig. 39).

CAUTION: The wheel speed sensor cable connectors for the left and right rear wheel speed sensors are keyed differently. Therefore, when connecting a wheel speed sensor cable to the vehicle wiring har-

ness, do not force the connectors together. If the connectors are forced together, damage to the connectors will occur.

(7) Plug speed sensor cable connector into vehicle wiring harness (Fig. 37). **Be sure speed sensor cable connector is fully seated and locked into vehicle wiring harness connector.**

(8) Install the speed sensor cable grommet into the body, being sure the grommet is fully seated into the body hole.

(9) Install the tire and wheel assembly on vehicle.

(10) Road test vehicle to ensure proper operation of the base and ABS braking systems.

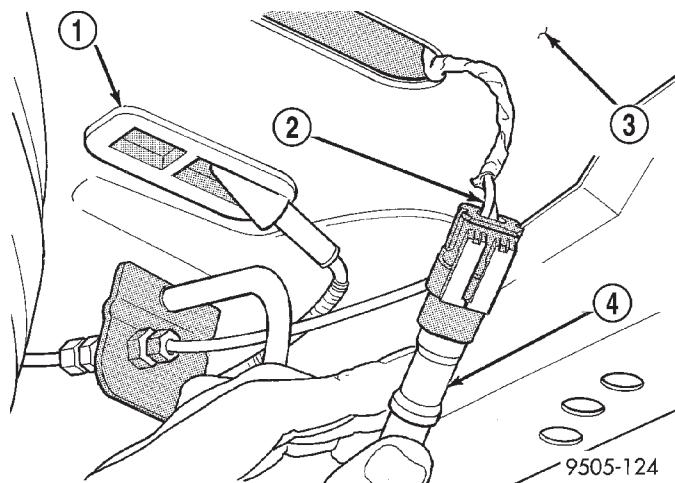
WHEEL SPEED SENSOR (REAR AWD)**REMOVE**

(1) Raise vehicle on jack stands or centered on a frame contact type hoist. See Hoisting in the Lubrication and Maintenance section of this manual, for the required lifting procedure to be used for this vehicle.

(2) Remove the tire and wheel assembly from the vehicle.

CAUTION: When unplugging speed sensor cable from vehicle wiring harness be careful not to damage pins on the electrical connectors. Also inspect connectors for any signs of previous damage.

(3) Remove grommet from floor pan of vehicle and unplug speed sensor cable connector from vehicle wiring harness (Fig. 42).

**Fig. 42 Speed Sensor Cable Connection To Vehicle Wiring Harness**

- 1 – GROMMET
 2 – VEHICLE WIRING HARNESS
 3 – FLOOR PAN
 4 – SPEED SENSOR CABLE

REMOVAL AND INSTALLATION (Continued)

CAUTION: When removing rear wheel speed sensor cable from routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during removal of the speed sensor cable.

- (4) Carefully remove the speed sensor cable from the rear brake flex hose routing clips (Fig. 43).

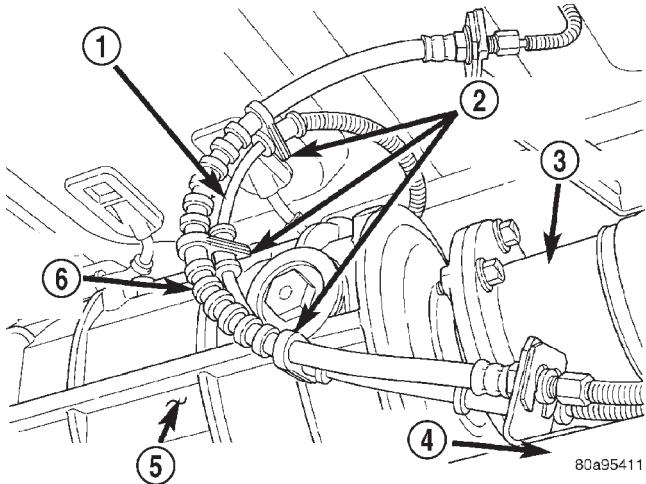


Fig. 43 Speed Sensor Cable Attachment To Brake Flex Hose

- 1 – WHEEL SPEED SENSOR CABLE
- 2 – ROUTING CLIPS
- 3 – DRIVESHAFT
- 4 – REAR AXLE
- 5 – REAR DRIVELINE MODULE
- 6 – BRAKE FLEX HOSE

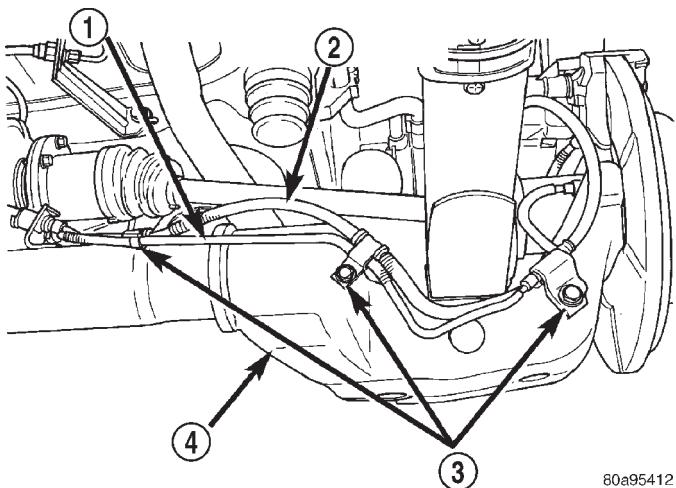
- (5) Remove the rear wheel speed sensor cable/brake tube routing clips (Fig. 44). Then un-clip the speed sensor cable from the routing clips on rear brake tube (Fig. 44).

CAUTION: If the speed sensor has seized, due to corrosion, do not use pliers on speed sensor head in a attempt to remove it. Use a hammer and a punch and tap edge of sensor, rocking the sensor from side to side until free.

- (6) Remove the wheel speed sensor attaching bolt (Fig. 45). If sensor head does not come loose, do not use pliers on the sensor head to loosen. Tap sensor head from side to side to loosen.

- (7) Remove the wheel speed sensor from the rear bearing assembly.

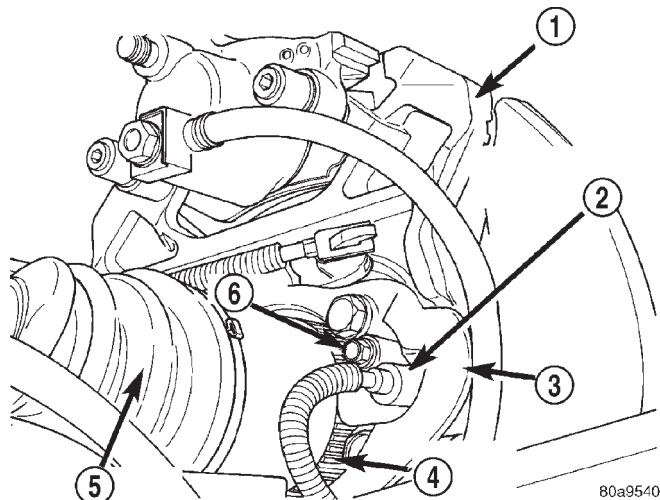
- (8) Remove the speed sensor assembly from the vehicle.



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Fig. 44 Rear Speed Sensor Routing Brackets And Clips

- 1 – BRAKE TUBE
- 2 – WHEEL SPEED SENSOR CABLE
- 3 – ROUTING CLIPS
- 4 – REAR AXLE



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Fig. 45 Speed Sensor Attaching Bolt

- 1 – ADAPTER
- 2 – WHEEL SPEED SENSOR
- 3 – AXLE
- 4 – TONE WHEEL
- 5 – DRIVESHAFT
- 6 – BOLT

INSTALL

CAUTION: Proper installation of wheel speed sensor cables is critical to continued system operation. Be sure that cables are installed in retainers. Failure to install cables in retainers as shown in this section may result in contact with moving parts and/or over extension of cables, resulting in an open circuit.

REMOVAL AND INSTALLATION (Continued)

(1) Install wheel speed sensor head. Note, the plastic anti rotation pin must be fully seated prior to installing the attaching bolt.

CAUTION: Prior to installing the speed sensor head attaching bolt, the plastic anti-rotation pin must be fully seated into the bearing flange.

(2) Install the wheel speed sensor head attaching bolt (Fig. 45). Tighten the attaching bolt to a torque 12 N·m (105 in. lbs.)

(3) Check the air gap between the face of the wheel speed sensor and the top surface of the tone-wheel. Air gap must be less then the maximum allowable tolerance of 1.2 mm (.047 in.).

(4) Install the routing brackets attaching the speed sensor cable and brake tube to the rear axle (Fig. 44). **The rear wheel speed sensor cable should be routed under the rear brake tube (Fig. 44).**

CAUTION: When installing rear wheel speed sensor cable in the routing clips on rear brake flex hose, be sure not to damage the routing clips. Routing clips are molded onto the hose and will require replacement of the brake flex hose if damaged during installation of the wheel speed sensor cable.

(5) Install speed sensor cable into routing clips on rear brake flex hose (Fig. 43).

CAUTION: The wheel speed sensor cable connectors for the left and right rear wheel speed sensors are keyed differently. Therefore, when connecting a wheel speed sensor cable to the vehicle wiring harness, do not force the connectors together. If the connectors are forced together, damage to the connectors will occur.

(6) Plug speed sensor cable connector into vehicle wiring harness (Fig. 42). **Be sure speed sensor cable connector is fully seated and locked into vehicle wiring harness connector.**

(7) Install the speed sensor cable grommet into the body, being sure the grommet is fully seated into the body hole.

(8) Install the tire and wheel assembly on vehicle.

(9) Road test vehicle to ensure proper operation of the base and ABS braking systems.

DISASSEMBLY AND ASSEMBLY

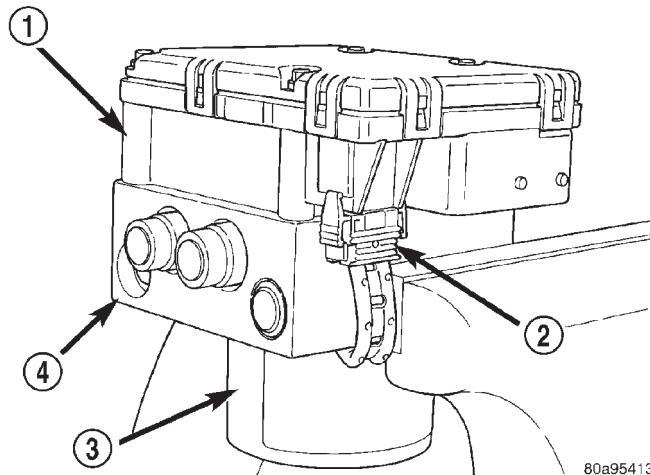
INTEGRATED CONTROL UNIT

REMOVAL

NOTE: To replace the hydraulic control unit (HCU) or the controller antilock brake (CAB) on this vehicle, the entire integrated control unit (ICU) needs to be removed from the vehicle. The CAB can then be separated from the HCU. Do not attempt to replace the CAB with the ICU mounted in the vehicle.

(1) Remove the ICU from the vehicle. Refer INTEGRATED CONTROL UNIT in the REMOVAL AND INSTALLATION section in this section of the service manual.

(2) Disconnect the pump/motor wiring harness (Fig. 46) from the CAB.

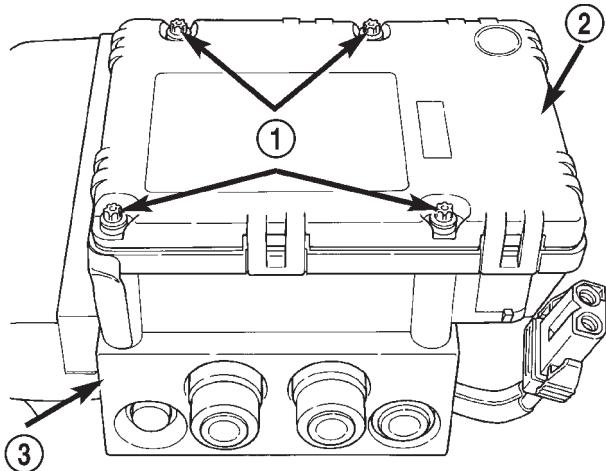


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Fig. 46 Pump/Motor To CAB Wiring Harness

- 1 – CAB
- 2 – PUMP MOTOR WIRING HARNESS
- 3 – PUMP MOTOR
- 4 – HCU VALVE BLOCK

(3) Remove the 4 bolts (Fig. 47) attaching the CAB to the HCU.



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Fig. 47 CAB Attaching Bolts

- 1 – MOUNTING BOLTS
- 2 – CAB
- 3 – HCU VALVE BLOCK

DISASSEMBLY AND ASSEMBLY (Continued)

- (4) Remove the CAB from the HCU (Fig. 48).

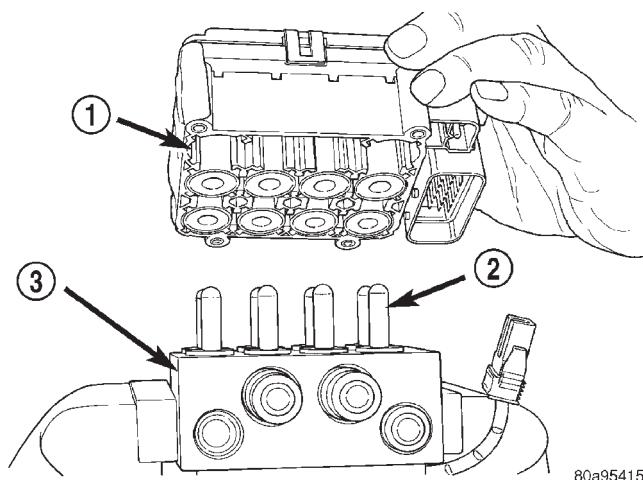


Fig. 48 Remove/Install CAB

- 1 - CAB
2 - HCU VALVES
3 - HCU VALVE BLOCK

INSTALLATION

- Install the CAB (Fig. 48) on the HCU.
- Install the 4 bolts mounting the CAB (Fig. 47) to the HCU. Tighten the CAB mounting bolts to a torque of 2 N·m (17 in. lbs.).
- Plug the pump/motor wiring harness into the CAB (Fig. 46).
- Install the ICU in the vehicle.
- Bleed the base and ABS hydraulic systems. Refer to ANTILOCK BRAKE SYSTEM BLEEDING in this section of this service manual group.
- Road test the vehicle to ensure proper operation of the base brakes and ABS.

SPECIFICATIONS

TONE WHEEL RUNOUT

FRONT TONE WHEEL:

Maximum Runout 0.15 mm (0.006 in.)

REAR TONE WHEEL:

Maximum Runout 0.15 mm (0.006 in.)

WHEEL SPEED SENSOR-TO-TONE WHEEL CLEARANCE

FRONT WHEEL:

Minimum Clearance 0.35 mm (0.014 in.)

Maximum Clearance 1.20 mm (0.047 in.)

REAR WHEEL:

Minimum Clearance 0.40 mm (0.016 in.)

Maximum Clearance 1.20 mm (0.047 in.)

WHEEL SPEED SENSOR RESISTANCE

FRONT AND REAR:

Allowable Resistance 900 - 1300 ohms

BRAKE FASTENER TORQUE SPECIFICATIONS

DESCRIPTION TORQUE

Master Cylinder:

Mounting Nut 25 N·m (225 in. lbs.)

Power Brake Booster:

Dash Panel Mounting Nuts 28 N·m (250 in. lbs.)

Brake Tubes And Hoses:

Tube Nuts 17 N·m (145 in. lbs.)

Hose Intermediate Bracket bolt 12 N·m (105 in. lbs.)

Hose To Caliper Banjo Bolt 47 N·m (35 ft. lbs.)

Junction Block (Non-ABS Brakes)

To Suspension Cradle Mounting Bolt 28 N·m (250 in. lbs.)

Proportioning Valve (Fixed-ABS):

Frame Rail Attaching Bolts 14 N·m (125 in. lbs.)

Proportioning Valve (Height Sensing-Non-ABS):

Mounting Bracket Attaching Bolts 23 N·m (200 in. lbs.)

Actuator Assembly Adjustment Nut 5 N·m (45 in. lbs.)

Mounting Bracket To Frame Rail Bolts 17 N·m (150 in. lbs.)

Disc Brake Caliper (All):

Guide Pin Bolts 22 N·m (195 in. lbs.)

Bleeder Screw 15 N·m (125 in. lbs.)

Drum Brake Wheel Cylinder (Rear):

Support Plate Mounting Bolts 8 N·m (75 in. lbs.)

Bleeder Screw 10 N·m (80 in. lbs.)

Drum Brake Support Plate:

To Rear Axle Mounting Bolts 130 N·m (95 ft. lbs.)

Parking Brake:

Lever (Pedal) Mounting Bolts 28 N·m (250 in. lbs.)

Integrated Control Unit (ABS):

Mounting Bracket To Suspension Cradle Bolts 28 N·m (250 in. lbs.)

Mounting Bracket Isolator

Attaching Bolts 11 N·m (97 in. lbs.)

CAB To HCU Mounting Screws 2 N·m (17 in. lbs.)

Wheel Speed Sensor (ASB):

To Axle Or Steering Knuckle

Mounting Bolt 12 N·m (105 in. lbs.)

Tire And Wheel Assembly:

Wheel Mounting Nut 135 N·m (100 ft. lbs.)

